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REPORT

ON THE

SCIENTIFIC RESULTS

OF THE

VOYAGE OF H.M.S. CHALLENGER

DURING THE YEARS 1873-76

UNDER THE COMMAND OF

CAPTAIN GEORGE S. NARES, R.N., F.R.S.

AND

CAPTAIN FRANK TOURLE THOMSON, R.N.

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ONE OF THE NATURALISTS OF THE EXPEDITION

UNITED STATES COMMISSION
2238
FISH & FISHERIES

ZOOLOGY—VOL. VIII.

PART XXV.—REPORT ON THE CIRRIPEDIA—SYSTEMATIC PART

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EDITORIAL NOTE.

This Memoir forms Part XXV. of the Zoological Series of Reports on the Scientific Results of the Expedition, and is the first instalment of Dr. P. P. C. Hoek's Report on the Cirripedia collected during the Expedition. A Supplementary Memoir will be published in the course of a few months dealing with the Anatomy of the Group. The Manuscript was received on the 31st August 1883.

John Murray.

Challenger Office, 32 Queen Street,
Edinburgh, 28*th December* 1883.

THE

VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.

REPORT on the CIRRIPEDIA collected by H.M.S. Challenger during the years 1873–76. By Dr. P. P. C. HOEK, Member of the Royal Academy of Science of the Netherlands.

INTRODUCTION.

THE Cirripedia form together a group of Crustacea which, generally (Gerstäcker, Claus), is considered as an Order. The information we possess with regard to this Order is by no means insignificant: the splendid Monographs of which Charles Darwin has made it the subject[1] are alone sufficient to place it among the best known groups of invertebrate animals. The publication of these Monographs has been so eventful in the development of our knowledge of the group that I may be allowed to divide the history of that knowledge into two periods:—

I. Before the publication of Darwin's Monographs; and
II. From this publication up to the present date.

It would be quite superfluous to enter into details with regard to the history during the first period. As Darwin says in the preface of his Monograph on the Lepadidæ (p. 8), this history has been fully given by Burmeister[2] and by Martin St.-Ange,[3] and

[1] Darwin, C., A Monograph on the sub-class Cirripedia, with figures of all the species, Lepadidæ (1851), Balanidæ, Verrucidæ, &c. (1854), London, Ray Society. A Monograph on the fossil Lepadidæ, or pedunculated Cirripedes of Great Britain, London, 1851. A Monograph on the fossil Balanidæ and Verrucidæ of Great Britain, London, 1854.

[2] Burmeister, H., Beiträge zur Naturgeschichte der Rankenfüsser, Berlin, 1834.

[3] Martin Saint-Ange, G. J., Mémoire sur l'organisation des Cirripèdes et sur leurs rapports naturels avec les animaux articulés, *Mém. Savans étrangers*, vi. p. 513–555, Paris, 1835.

what was published between the dates of the works of these authors and that of Darwin's Monographs is to be found in the above preface. Moreover, this history has met with an exhaustive treatment at the hands of Prof. Gerstäcker, in Bronn's Klassen und Ordnungen des Thierreichs.[1] The parts in which the Cirripedia are treated were published in 1869, and so we find in the German work the history of our group continued till about 1867.

Of Darwin's Monographs two (1851 and 1854) give descriptions of the living species, two others (published in the same years) descriptions of the fossil ones. In the first, moreover, the anatomy, embryology, &c., of the different forms find ample treatment. The descriptions of the species are extremely exhaustive, each forming almost a monograph of its own; the discussion of the relations between the different species, and also of those existing between the genera, is doubtless among the best published in this department of Invertebrate Zoology. Finally, his studies, perhaps even more than those of Cuvier,[2] of Martin Saint-Ange, and Burmeister, are contributions to our knowledge of the anatomy of the group, and so have proved very valuable to Animal Morphology in general.

The way in which Darwin has compiled all the information scattered through zoological literature has been so thoroughly exhaustive and accurate, the way in which he made use of this information has been so very critical, that his works must necessarily form the basis of all future investigations. In comparison with the immense quantity of scientific information contained in his publications, but little has been added to our knowledge of the group since their appearance. I propose to bring these additions under three different heads:—

1. A sketch of the development of our knowledge with regard to the number of the genera and species known, their geographical and bathymetrical distribution.
2. A summary of what has been added to our knowledge of the anatomy, embryology, &c., of the group; and
3. A discussion of the different opinions published with regard to the classification of the group, especially since the discovery of the so-called Cirripedia Suctoria or Rhizocephala.

Under the first head I shall also refer briefly to the fossil genera and species described since the publication of Darwin's Monographs. It is much to be regretted that I have not been able to make the summary of the literature in this department more complete. As it was an utter impossibility to go personally over the whole of zoological literature

[1] Gerstäcker, A., Die Klassen und Ordnungen der Arthropoden wissenschaftlich dargestellt in Wort und Bild, Abtheilung 1, Crustacea, Hälfte 1, Leipzig und Heidelberg, 1865–79; Rankenfüssler, pp. 406–589, Taf. I.–VI.

[2] Cuvier, G., Mémoires pour servir à l'histoire naturelle et l'anatomie des Mollusques, Article Anatifa, 1817.

in search of descriptions of new fossil or recent species, my labours in this direction have been limited to examining carefully the contents of the different records of zoological literature.[1] Under the first head I shall treat only of the true nonparasitical Cirripedia.

Since the publication of Darwin's remarkable monograph, the Cirripedia of the English coast, and of the surrounding seas, have not much occupied zoologists. Only occasionally faunistic observations have been made and published, *e.g.*, by the Rev. A. M. Norman[2] (1868), in his report on the Shetland Crustacea. Three species of *Balanus* are mentioned in it, moreover, *Verruca strömia*, *Scalpellum vulgare*, and *Alcippe lampas*. The observations made by Lawson[3] (1858) and Adams[4] (1861) are rather biological than faunistic.

Leslie and Herdman[5] (1881) observed in the Firth of Forth one species of *Lepas*, two of *Conchoderma*, and four of *Balanus*. No new species were collected.

In more northern latitudes the Cirripedia are not represented by very many species. M. Sars[6] (1857) observed a new species of *Scalpellum* (*Scalpellum stroemii*) near Bergen, on the long spines of *Cidaris papillata*, living at a depth of 80 to 150 fathoms. Five other Cirripedia were collected by him in the North-Arctic region (four species of *Balanus* and one of *Verruca*). According to Heller[7] (1875), the only Cirriped taken during the Austro-Hungarian North-Polar Expedition is *Scalpellum stroemii*, Sars. Prof. G. O. Sars,[8] however, pointed out that the species of Heller is quite distinct from that of M. Sars: he therefore suggests a new name for it, and calls it *Scalpellum angustum*. During the great Norwegian North-Atlantic Expedition[9] three new species of *Scalpellum* (*Scalpellum striolatum*, *Scalpellum cornutum*, and *Scalpellum hamatum*; the first at a depth of 412 and 1081 fathoms; the second of 148, 350, and 416 fathoms; the third of 416, 457, and 620 fathoms) were added to those previously known, whereas at the same time the occurrence of *Scalpellum vulgare* at a latitude of 64° N. was ascertained.

In the Arctic region *Balanus porcatus*, Da Costa, occurs on the east coast of Greenland (Buchholtz),[10] near Cape Napoleon, Smith Sound, lat. 79° N. (Miers),[11] Barents-Sea and

[1] *Archiv. für Naturgeschichte*, 1855–1882; *Zoological Record*, vols. i.–xvii., 1864–1880; *Zoologischer Anzeiger*, vols. i.–vi. 1878–1883.

[2] Gwyn Jeffreys, Rev. A. Merle Norman, &c., Last Report on Dredging among the Shetland Isles, *Report Brit. Assoc.*, 1868, p. 301.

[3] Lawson, G., Remarks on Lepas anatifera, Lin., *Ann. Mag. Nat. Hist.*, ser. 3, vol. ii. 1858, p. 172.

[4] Adams, A., On the rapid growth of Cirripedes, *Zoologist*, 1861, p. 7321.

[5] Leslie, G. and W. A. Herdman, The Invertebrate Fauna of the Firth of Forth, *Trans. Roy. Phys. Soc.*, Edinburgh, 1881.

[6] Sars, M., Oversigt over de i den norsk-arctiske Region forekommende Krebsdyr. *Forhandl. Vidensk-Selsk Christiania*, 1859.

[7] Heller, C., Crustaceen, Pycnogoniden und Tunicaten der k. k. Oester.-Ungar. Nordp. Exped., *Denkschr. d. Math. Naturv. Cl. d. k. Akad. d. Wiss. Wien*, Bd. xxxv. 1875.

[8] Sars, G. O., Crustacea et Pycnogonida nova, *Archiv f. Math. og Naturv.*, Bd. iv. 1879, Kristiania.

[9] Sars, G. O., Prodromus descriptionis Crustaceorum et Pycnogonidarum, *Archiv f. Math. og Naturv.* Bd. ii. 1877, Kristiania.

[10] Buchholtz, R., Zweite deutsche Nordpolarfahrt, II. Zoologie, Cirrhipedia, p. 396, 1874.

[11] Miers, Edw. J., Crustacea in Sir G. Nares' Narrative of a Voyage to the Polar Sea, vol. ii. p. 240–248, 1878.

Matotschkin-Shar (Nowaja-Zemlja) (Hoek),[1] &c. *Balanus balanoides*, Linn., was collected near Port Foulke, Arctic America (Mörch),[2] and in the Matotschkin-Shar (Hoek); *Balanus crenatus*, Brug., finally, occurs in Discovery Bay, Greenland, in 30 fathoms (Mörch).

The species of Cirripedia occurring at the coast of Bohuslän are enumerated by A. W. Malm[3]; they are of the non-parasitic species, three species of *Balanus*, *Verruca strömia*, *Lepas anatifera*, *Lepas hillii*, and *Lepas fascicularis*, *Conchoderma virgatum*, and *Anelasma squalicola*.

The Cirripedia of the Baltic belong all to the genus *Balanus*. According to Prof. Möbius[4] they are *Balanus crenatus*, *Balanus perforatus*, and *Balanus improvisus*. The latter was observed in 1868, in the brackish water of the Eyk River, by Prof. Julius Münter,[5] and is found, moreover, at several points on the northern shores of Germany (Metzger).[6]

The Cirripedia of the German coast are not very numerous. Metzger[7] (1870) only mentions *Balanus perforatus*, *Balanus crenatus*, and *Balanus balanoides*, *Verruca strömia*, *Lepas anatifera*, and *Lepas anserifera*. *Chthamalus stellatus*, Poli, sp. is found near Heligoland, as was observed by me in 1877. Frey and Leuckart[8] (1847) described two new species of the same genus from the coast of Heligoland, but they are no doubt varieties of the species named above.

A list of the species found on the Dutch coast was published by me[9] in 1878. I observed only four species of *Balanus*, *Lepas anatifera*, and *Verruca strömia*. For the Belgian coast P. J. van Beneden[10] (1861) mentions only *Lepas anatifera* and a species of *Balanus*.

Of the Cirripedia of the French coast we possess lists published by Caillaud[11] (1863) and by Fischer[12] (1872). The latter enumerates eighteen different species:—four

[1] Hoek, P. P. C., Crustaceen gesammelt während der Fahrten des Willem Barents, 1878 and 1879, *Middel. Arch. f. Zool.* Suppl., Bd. i, 1882.

[2] Mörch, Edw. J., On a small collection of Crustacea made in the North Greenland Seas, *Journ. Linn. Soc. Lond., Zoology*, xv., 1880.

[3] Malm, A. W., Om Cirripeder funna vid Bohusläns Kust, pp. 26-32, *Göteborgs Kongl. Museum. Årsb.-Zool.* 4pd. 1862.

[4] Möbius, K., Die wirbellosen Thiere der Ostsee, *Jahresber. d. Commiss. z. wissensch. Unters. d. deutschen Meere*, i. 1873.

[5] Münter, J., und Buchholz, Ueber Balanus improvisus, *Mitth. naturwiss. Vereins v. Neu-Vorpommern u. Rügen*, i., 1868, pp. 1-46.

[6] Metzger, A., Balanus improvisus, Darw., *Nachr. d. Deutschen mal. Gesellsch.* Bd. v. 1873, No. 1, pp. 7-8.

[7] Metzger, A., Die wirbellosen Meerestiere der ostfriesischen Küste, Erster Beitrag, Hannover, 1870.

[8] Frey, H. und R. Leuckart, Beiträge zur Kenntniss wirbelloser Thiere, Braunschweig, 1847.

[9] Hoek, P. P. C., Eerste bijdrage tot de kennis der Cirripedien der Nederlandsche Fauna, *Tijdschr. der Ned. Dierk. Ver.*, Bd. iii., 1878, pp. 1-46.

[10] Van Beneden, P. J., Recherches sur la faune littorale de Belgique, Crustacés, Bruxelles, 1861.

[11] Caillaud, F., Catalogue des Balanites, des Annélides, des Cirripèdes et des Mollusques recueillis dans le département de la Loire-inférieure, Nantes, 1863.

[12] Fischer, Paul, Crustacés Podophthalmes et Cirrhipèdes du département de la Gironde et des côtes du Sud-Ouest de la France, Actes de la Soc. Linnéenne de Bordeaux, xxviii., 1872.

hamata. The same author of late (1883) has published a short note,[1] in which he mentions a species of the same genus *Kochlorine*, probably different from his *Kochlorine hamata*, and inhabiting cavities in a *Haliotis* shell from the Cape of Good Hope. For this second species the name of *Kochlorine bihamata* is proposed.

The Cirripedia of the North-American coast have been somewhat neglected by zoologists. In the report upon the invertebrate animals of Vineyard Sound and the adjacent waters, published (1873) by Prof. A. E. Verrill,[2] and in Dr. Spencer F. Baird's report for 1872, five species of *Balanus* (*Balanus amphitrite, Balanus eburneus, Balanus improvisus, Balanus crenatus*, and *Balanus balanoides*); *Coronula diadema*; four species of *Lepas* (*Lepas anatifera, Lepas anserifera, Lepas pectinata*, and *Lepas fascicularis*); and two species of *Conchoderma* (*Conchoderma auritum* and *Conchoderma virgatum*) are enumerated.

Macdonald[3] (1869) published a description of an "apparently new genus of minute parasitic Cirripeds, between *Lepas* and *Dichelaspis*." The species is called *Paradolepas neptuni*, and was found on the gills and respiratory appendages of *Neptunus pelagicus*, one of the swimming crabs occurring in great plenty at Moreton Bay (Australia). The species is, also, according to him, abundant at Sydney, and amongst the islands of the south-western Pacific. I believe the genus *Paradolepas* to be synonymous with *Dichelaspis*, Darwin. Macdonald met with another small pedunculate Cirriped in Nandi Bay, Vanua Levu, Fiji, also parasitic upon a swimming crab, but he neglected to decide whether this was identical with the other or not.

F. W. Hutton[4] (1878) has published a list of the New Zealand Cirripedia in the Otago Museum. The short notice contains an enumeration of eighteen species of Cirripedia, the description of two new species of *Elminius* (*Elminius sinuatus* and *Elminius rugosus*), and one new *Pollicipes* (*Pollicipes darwinii*), all three from New Zealand.

Fritz Müller[5] (1867) observed in Desterro, southern Brazil, a new species of *Balanus* (*Balanus armatus*). The species lives in sponges, and is distinguished by a rich and very peculiar armature of its cirri. The commonest species of *Balanus* occurring in the same locality is *Balanus improvisus*, var. *assimilis*, and the same author describes a probable hybrid between this variety and his *Balanus armatus*.

With regard to the Cirripedia inhabiting the skin of whales, we possess a paper from W. H. Dall,[6] and a short note, published by Steenstrup as a footnote to Lütken's Mono-

[1] Noll, F. C., Zur Verbreitung von Kochlorine, N., *Zoologischer Anzeiger*, No. 147, 1883, p. 471.

[2] Verrill, A. E., Report upon the Invertebrate Animals of Vineyard Sound, *U.S. Commission of Fish and Fisheries*, Part I., Washington, 1873.

[3] Macdonald, J. D., On an apparently new Genus of minute Parasitic Cirripeds, between Lepas and Dichelaspis, *Proc. Zool. Soc. Lond.*, 1869, p. 440.

[4] Hutton, F. W., List of the New Zealand Cirripedia in the Otago Museum, *Trans. N. Z. Instit.*, xi., 1878.

[5] Müller, F., Ueber Balanus armatus und einen Bastard dieser Art und des Balanus improvisus var. assimilis, Darw., *Archiv f. Naturgesch.*, Jahrg. xxxiii., 1867.

[6] Dall, W. H., *Proc. Californ. Acad.*, 1872.

graph of *Cyamus*.[1] The first (1872) mentions *Coronula diadema*, Lam., or perhaps a similar but distinct species from *Megaptera versabilis* of north-west America; *Cryptolepas rhachianectis*, a new genus and species of sessile Cirripedia found on *Rhachianectes glaucus*, Cope; in the third place *Otion stimpsoni*, Dall, sessile on *Coronula*, infesting *Megaptera versabilis*, but never on the surface of the whale itself. Steenstrup (1873) enumerates *Coronula balaenaris*, Gmelin, on right whales of the northern and southern hemispheres; *Coronula diadema*, Linn., on *Megaptera boops*, Atlantic and also southern hemisphere; *Coronula reginæ*, Darw., on unknown whales of the South Sea; *Tubicinella trachealis*, Sav., on northern and southern right whales; *Xenobalanus globicipitis*, Steenstrup, on *Globiocephalus melas* from the Faröe; finally, *Xenobalanus strictus*, Steenstrup, on several species of *Delphinus* from warmer parts of the Atlantic. Sars[2] (1880) observed *Conchoderma* (*vittatum*) *virgatum* on *Penella balaenopteræ*, which was taken from *Balaenoptera musculus*, and *Conchoderma auritum* and *Coronula diadema* on *Megaptera boops*.

During the cruise of the Austrian man-of-war "Novara," a small collection of Cirripedia was made. This was determined by Heller[3] (1865), and contained the following species:—*Lepas anatifera*, from the Cape of Good Hope; *Lepas anserifera*, from the Nicobars and Shanghai; *Lepas fascicularis*, from Rio Janeiro; *Conchoderma auritum*, from Auckland; *Pollicipes mitella*, from Hong Kong; *Balanus tintinnabulum*, from Madras and Chili; *Tetraclita porosa*, from Sydney; and *Chthamalus cirratus*, from the Nicobars.

A new species of *Dichelaspis* (*Dichelaspis aymonini*) was observed (1874) on the gills of *Macrochira kaempferi*, by Lessona and Tapparone-Canefri.[4] A new genus (*Ornitholepas*) was proposed (1874) by Targioni-Tozzetti[5] for a species of Cirripedia inhabiting the tail feathers of *Priofinus cinereus*, a bird of the Southern Atlantic and the Indian Ocean. Gerstäcker[6] supposes that the *Ornitholepas australis*, Targioni-Tozzetti, is only a larva of a Cirriped in its *Cypris*-stage.

Miers[7] (1881) observed one species of *Balanus* in a collection of Crustaceans from the Straits of Magellan, and two species of the same genus collected at Goru Island. The same author[8] (1880) took a great number of specimens of *Alepas tubulosa* from *Palinurus hügeli*, Heller, from Sydney Harbour.

[1] Lütken, Monograph of Cyamus, *Dan. Selsk. Skrift.* (5) x. p. 244, 1873.

[2] Sars, G. O., Fortsatte Bidrag til Kundskaben om vore Bardehvaler "Finhvalen" og "Knöllhvalen," *Forhandl. Vidensk. Selsk.*, Christiania, 1880.

[3] Heller, C., Reiseder Novara., Zool. Theil., Bd. ii., Abth. 3, Crustaceen, Vienna, 1865.

[4] Lessona and Tapparone-Canefri, *Atti Acad. Torino.*, ix., 1874.

[5] Targioni-Tozzetti, Di una specie nuova in un nuovo genere di Cirripedi Lepadidei, *Bull. Soc. Entom. Ital.*, iv., 1872.

[6] Gerstäcker, A., *Sitzber. Gesellsch. naturf. Freunde*, Berlin, 1875.

[7] Miers, Edw. J., Account of the Zool. Coll. made during the Survey of H.M.S. "Alert," Crustacea, *Proc. Zool. Soc. Lond.*, 1881.

[8] Miers, Edw. J., *Ann. and Mag. Nat. Hist.*, ser. 5, vol. v. 1880, p. 379.

Smith[1] (1880) observed *Tetraclita porosa* and *Lepas anatifera* in a collection of Crustaceans from Vancouver and Queen Charlotte Islands.

Ryder[2] (1879) observed a specimen of *Platylepas decorata*, Darwin, upon *Lepidosteus*.

These are all the new facts which I have been able to bring together relating to the number and geographical distribution of the living Cirripedia, and published since the appearance of Darwin's Monographs. In this department—as I have already said—the increase of our knowledge has not been considerable. The same may be said with respect to the fossil species. The results arrived at by Darwin are well known, and may be briefly summed up as follows :—

The genus *Pollicipes* embraces the oldest known Cirripeds,—*Pollicipes oolithicus* from the Lower Oolite, *Pollicipes concinnus* from the Middle Oolite, &c. In the Upper Chalk and the so-called Maestricht Formation the number of species known is the greatest.

The genus *Scalpellum* is the second ; it makes its appearance in the Lower Greensand, and is represented by about the same number of species as *Pollicipes* in the Upper Chalk.

The genus *Loricula* comes next ; the species described by Darwin is from the Lower Chalk. It is the only genus of fossil Cirripedia of which no recent representatives are known.

The genus *Verruca* is the first of the sessile[3] Cirripedia which makes its appearance. The oldest known species, *Verruca prisca*, is found fossil in Chalk, and in the Maestricht Formation. All the other sessile Cirripedia are represented in the Tertiary stages only.

The genus *Balanus* is represented by a single species in the Eocene ; the number of species increases towards the younger Tertiary deposits, but Darwin believes that if all the species of *Balani* hitherto found in the several Tertiary formations, from the Eocene to the Glacial deposits, throughout Europe, were collected together, they would not amount to twenty species. The number of recent species described by Darwin amounts to forty-five.

The genera *Acasta* and *Pyrgoma* are each represented by a single species in the Coralline Crag. Of both genera Darwin has mentioned nine living species.

The genus *Coronula* appears for the first time in the Red Crag. At present the genus numbers three species.

In 1857 a very interesting paper of Bosquet[4] was published on the fossil Cirripeds of the so-called Maestricht Formation. This paper contains the description of one new

[1] Smith, S. J., Notes on Crustacea collected by Dawson at Vancouver and the Queen Charlotte Islands, *Rep. Progr. Geol. Survey*, Canada, 1878–79.

[2] Ryder, John A., *American Naturalist*, July 1879.

[3] Darwin considers the Verrucidæ as a distinct family—according to him, therefore, *Balanus* is the oldest known genus of sessile Cirripedia.

[4] Bosquet, J., Notice sur quelques Cirripèdes récemment découverts dans le terrain Crétacé du Duché de Limbourg, *Natuurk. Verhandel. v. d. Holl. Maats. v. Wetensch.* Tweede Verzamel., xiii., 1857.

species of *Chthamalus*, one of *Verruca*, one of *Scalpellum*, and three of *Pollicipes* (*Mitella*, Oken, as Bosquet calls the genus), moreover, short notes about some species, descriptions of which were published by Darwin or by Bosquet in his Crustacés fossiles du terrain crétacé du Duché de Limbourg, 1853. The most interesting feature of the new publication of Bosquet is, in the first place, that *Chthamalus* is shown to occur in the Chalk of the Maestricht Formation,—the first instance of a true Balanid in secondary formations, if, with Darwin, we consider *Verruca* as a representative of a distinct family. In the second place, that a second species of *Verruca* was added to the only one known as occurring in secondary deposits.

In two different papers (1861 and 1864) Reuss[1] has largely increased our knowledge with regard to the fossil Lepadids. He has described two new species of *Scalpellum* from Tertiary deposits of the Oligocene formation of Söllingen near Crefeld, one new *Pollicipes* and one new *Pœcilasma* of the same Tertiary stage. The latter is represented by a single valve, which, being symmetrical, is considered as a carina; of course, the determination of Reuss may be correct, but as this would be the first instance of a *Lepadid* nearly related to *Lepas* being found in a Tertiary deposit, I think we had better not take it into consideration for the present. We ought to act in the same way with regard to the single valve which represents—according to Reuss—another species of *Pœcilasma* and was found in the Miocene Leitha-chalk of Podjarkow in Galicia. In these Miocene deposits Reuss observed, moreover, two species of *Pollicipes* and one of *Scalpellum*. Finally, the same author enumerates some forms from the Bohemian Cretaceous formation (two species of *Pollicipes* and one of *Scalpellum*), and three *Pollicipes* from the Mucronate Chalk of Nagorrani. One of the latter species is new.

Conrad[2] (1865) was only acquainted with two Cirripedia in the Eocene deposits of North America, viz., *Balanus humilis*, Conr., and *peregrinus*, Mort. Seeley[3] (1870) proposed a new species and a new genus for a scutum and a tergum of a sessile Cirriped found among some Lias fossils obtained at Lyme Regis. As far as the shape and the articulation are concerned, the valves resemble those of the Balanidæ, though the former do not display the muscular scars which distinguish the latter; in this respect they resemble the Verrucidæ. For these various reasons the author is inclined to regard the specimen as the type of a new family, intermediate between the Balanidæ and Verrucidæ. The species is called *Zoocapsa dolichoramphia*. I need hardly say that I do not wish to follow the author in his reasoning on this topic.

In 1878, Dames[4] made the very interesting discovery of a second species of *Loricula*

[1] Reuss, A., *Sitzungsb. d. math-naturw. Cl. d. k. Akad. d. Wiss. Wien*, Bd. xl., 1861; Ueber fossile Lepadiden, *Ibid.*, xlix., 1864.

[2] Conrad, Catalogue of the Eocene Annulata, Foraminifera, Echinodermata, and Cirripedia of the U. S., *Proc. Acad. Nat. Sci. Philad.*, 1865.

[3] Seeley, H. G., On Zoocapsa dolichoramphia, *Ann. and Mag. Nat. Hist.*, ser. 4, vol. v. 1870.

[4] Dames, Neue Art der Cirripedien-Gattung Loricula, *Sitzungsb. d. Gesellsch. naturf. Freunde*, Berlin, 1878.

in the Cretaceous deposits of the Lebanon. *Loricula syriaca* is represented by a single example affixed to a specimen of *Ammonites syriacus*. The species is smaller than the one described by Darwin, but is much more complete, and shows the correctness of Darwin's supposition with regard to the identification of the valves. In a footnote Dames makes mention of a third species of the same genus *Loricula*, which—according to Prof. Zittel—was found in the Cretaceous deposits of Dülmen in Westphalia.[1] So the genus *Loricula* seems to occur in all the strata of the upper Cretaceous formation. Marsson[2] (1881) enumerated the fossil Cirripedia found in the White Chalk of Rügen. There occur in it six species of *Scalpellum*, two of *Pollicipes*, and one *Verruca;* one *Scalpellum* (*Scalpellum depressum*) and one *Pollicipes* (*Pollicipes cancellatus*) are new to science.

Martin[3] (1880) described three species of *Balanus* (*Balanus tintinnabulum*, *Balanus amphitrite*, and *Balanus amaryllis*), as occurring in the Tertiary strata of Java. The same author[4] (1881) states that *Balanus amaryllis* occurs in the stream-tin-deposits of Blitong, and also[5] in newer Tertiary strata in the Padang Highlands of Sumatra. Berkeley Cotter[6] (1881) observed in the marine Tertiary deposits "do Tejo, do Sado e do Algarve," only *Balanus tintinnabulum* and a second species of *Balanus* which he has not determined.

During the so-called Mammoth Expedition, F. Schmidt[7] (1872) observed three species of *Balanus* (*Balanus porcatus*, *crenatus*, and *hameri*) sub-fossil at the mouth of the river Yenisei.

Together, all these scattered notes tend to show that *Pollicipes* and *Scalpellum* are the oldest genera of Cirripedia, fossils of which have as yet been found; that with a single exception (*Loricula*) the fossil Cirripedia belong to the same genera which still inhabit the seas; that the sessile Cirripedia only appear long after the pedunculate forms, and that *Verruca* is the oldest genus of sessile Cirripedia known. Comparing the large amount of information contained in Darwin's palæontological monographs with what has since been added to our knowledge, we need not wonder that the above-mentioned conclusions are nearly the same as those Darwin came to in 1854.

Recently Clarke[8] (1882) has published a note in which a "Cirriped Crustacean from the

[1] Under the name *Encrinurus egani*, n. sp., S. A. Miller has described (1879) a trilobite which, in general appearance at least, shows a very striking resemblance to *Loricula*. . . . (*Journ. Cincinnati Soc. Nat. Hist.*, vol. ii. 1879, p. 254, pl. xv. fig. 1). This fossil was found in the magnesian limestone of the Niagara group, at Joliet, Illinois.

[2] Marsson, Th., Die Cirripedien und Ostracoden der weissen Schreibkreide der Insel Rügen, *Mitth. naturwiss. Verein v. Neu-Vorpommern u. Rügen*, Bd. xii. 1881.

[3] Martin, K., Die Tertiärschichten auf Java, Leiden, Brill., 1879–80.

[4] Martin, K., On a post-tertiary fauna from the stream-tin-deposits of Blitong, *Notes Leiden Museum*, vol. iii. 1881.

[5] Martin und Wichman, Samml. des geologischen Reichsmuseums in Leiden (1), Bd. i. 1881–83.

[6] Cotter, J. C. Berkeley, Fosseis das bacias terciarias marinas do Tejo, do Sado e do Algarve, *Journ. Sci. Math. Phys. e Nat. Acad. Lisb.*, xxvi. 1881.

[7] Schmidt, F., *Mém. Acad. Sci. St. Pétersb.*, t. xviii. I. 1872.

[8] Clarke, J. M., Cirriped Crustacean from the Devonian, *Amer. Journ. Sci. and Arts*, ser. 3, vol. xxiv. 1882.

Devonian" is described. I learn from this note that Barrande has instituted a genus, *Plumulites*, for certain fossils regarded by him as the capitulum plates of sessile Cirripeds; this name *Plumulites* includes the genus *Turrilepis* proposed by Woodward for a form which he regarded as bearing a scaly peduncle; Barrande, "in regarding his specimens as all capitulum plates, and not the scales of the peduncle, has based his conclusions upon the external markings of the plates, rather than upon any such variation in shape and size as we should expect to find in the capitulum plates of a Lepadid." I have not been able to peruse the original work of Barrande; but judging from what Mr. Clarke states about the close resemblance of Barrande's specimens and his, and in the second place, from the figure Mr. Clarke gives of his specimens, the sessile nature of the Silurian and Devonian Cirriped appears to me to be very problematical. A good figure of the innermost side of the valve which is considered as the scutum of a sessile Cirriped would perhaps show the impossibility of supporting the view of Barrande and Clarke. The figure given resembles, by its triangular outline, the scutum of a Barnacle, but several species of *Scalpellum* and *Pollicipes* have scuta of a triangular outline as well. Finally, I need hardly recall the fact that they may be all capitulum plates, and yet belong to a pedunculate Cirriped.[1] However, the question whether these plates belong to a sessile or a pedunculate Cirriped must remain an open one; that they belong to Cirripedia can hardly be doubted, and this granted, we learn from it that our knowledge as to the distribution of the Cirripedia in time is very imperfect, and in the second place, that the conclusions arrived at, by comparing the living and the fossil forms, must be received with the greatest reserve.

With respect to the relation between the geological history of the Cirripedia and their occurrence at considerable depths, the information literature provides us with is extremely insignificant. Even the approximate ranges of depth at which the larger number of Cirripedia are found are not in our possession. Darwin (1854) says that *Balanus crenatus* inhabits water down to 50 fathoms, and (1851) that most of the species of *Scalpellum* are inhabitants of deep water. With the exception of the Norwegian Expedition of the "Voringen," the earliest attempts to increase our knowledge with regard to the inhabitants of the great depths of the ocean were fruitless as regards the Cirripedia. As far as I am aware the species of *Scalpellum*, dredged by Prof. G. O. Sars, and published in his lists of new Crustaceans and Pycnogonids of the expedition of the "Voringen," are the only instances, recorded in zoological literature, of animals of this order inhabiting the great depths of the ocean. In one of the letters, addressed to Prof. v. Siebold, during the voyage of H.M.S. Challenger, v. Willemoes Suhm stated that the only Cirriped often met with at a considerable depth, was the genus *Scalpellum*; but a careful examination of the collection put into my hands soon

[1] A third species of *Plumulites* (*Plumulites woodwardi*) has been described by Mr. Whitfield from the Huron (Genesee and Portage) shales (*New York Academy of Science*, March 1882).

brought to light the fact that it is by no means the only genus of deep-sea Cirripedia.

What has been added to our knowledge of the anatomy and embryology of the Cirripedia since the publication of Darwin's book?

The beautiful researches of Krohn[1] are no doubt the best published on the anatomy of the Cirripedia since that date; they contain a detailed description of the cement-apparatus of *Lepas* and *Conchoderma*, and for the first time an accurate description of the female genital organs of *Lepas* and *Balanus tintinnabulum*. It is well known that Darwin[2] hesitated to accept the results which Krohn arrived at with regard to the opening of the oviduct into the sac at the base of the first pair of cirri. The exactness of Krohn's description was acknowledged by Kossmann,[3] after having been disputed by Pagenstecher.[4] I may add that the opening of the oviduct into Darwin's "auditory sac" requires very delicate dissecting, but that once achieved, a microscopic preparation may be made of the sac with the oviduct attached to it. In one of my preparations the oviduct, at a short distance from the sac, contains ovarian eggs. As was accurately stated by Darwin, the sac often contains a proportionally large and laterally flattened second sac, the opening of which is directed towards and attached to the opening of the oviduct in the outermost sac. Of course, since the supposition of Darwin as to the auditory function of the whole apparatus must be abandoned, his opinion as to the nature of this sac cannot be accurate. Krohn supposes that this innermost sac is furnished with a very elastic wall, which, when the sac is full of eggs, dilates very considerably, and loosens itself from the attachment of the oviduct, forming in this way the ovigerous lamellæ.

Kossmann, on the contrary, calls this shoe-shaped sack a "Klumpen," *i.e.*, an irregularly-shaped mass. According to him, this, if not totally solid, is only furnished with very irregular cavities, which cannot be filled with eggs from the oviduct. Even if one of these cavities were in direct communication with the oviduct, the contractions of the latter could never develop the force necessary to swell out the body till it formed the very tender cuticle which encloses the eggs of the Lepadids. The mass does not show a trace of a cellular structure, and though very extensile, it is very tough also, and offers great resistance to any tearing with needles. The mass is evidently the product of an aimless secretion of the epithelium-cells of the sac at the extremity of the oviduct. When the eggs pass through the oviduct these cells

[1] Krohn, A., Beobachtungen über den Cementapparat und die weiblichen Zeugungsapparate einiger Cirripedien *Archiv. f. Naturgesch.*, Jahrg. xxv. 1859.

[2] Darwin, Ch., On the so-called "Auditory-Sac" of Cirripedes, *Nat. Hist. Review*, 1863.

[3] Kossmann, R., Suctoria und Lepadidæ, *Arbeit. zool. zoot. Instit. Würzburg.*, i., 1874.

[4] Pagenstecher, A., Beitrag zur Anatomie und Entwickelungsgeschichte von Lepas pectinata, *Zeitschr. f. wiss. Zool.*, Bd. xiii. 1863.

secrete a thin viscous fluid which envelops the eggs. When no eggs pass through the oviduct the secretion continues incessantly, and in this way a thick mass is formed.

It is not my opinion that this little sac is a useless organ, and I believe that, after all, the interpretation of Krohn is more in accordance with the facts than that of Kossmann. The latter author, moreover, made an elaborate study of *Anelasma squalicola*,[1] with the intent to show that this Cirriped is not "in an embryonic condition," as Darwin supposed, but in a rudimentary state in consequence of its parasitic mode of life. The root-like ramifications of the peduncle—observed by Darwin—do not serve only to attach the animal to the skin of the shark (as was supposed by Darwin); with their aid the Cirriped sucks the greater part of its food out of the skin of the animal in which it is embedded. The simple, degenerated, condition of the parts of the mouth and of the cirri is a rudimentary state in consequence of disuse. No details are given as to the condition of the intestinal tract in the animal in question: whether it is in open communication with the connective tissue of the peduncle, &c. The root-like excrescences of the peduncle of *Anelasma* are compared by Kossmann with the roots of the parasitic Cirripedia, and according to this author *Anelasma squalicola* is an intermediate form uniting together *Lepas* and the parasitic Cirripedia.

Embryological papers have appeared in great variety since the publication of Darwin's book. It is not my intention to enter into details upon each of them; I only wish to trace the present condition of our knowledge concerning the Cirripedia. The curious metamorphosis of the Crustaceans of this Order discovered by Thompson,[2] is amply discussed in Darwin's Monograph. The researches made and published during the last thirty years bear almost entirely upon the segmentation of the egg and the formation of the blastoderm, which processes, since the publication of the papers of Filippi,[3] Münter and Buchholtz,[4] Hoek,[5] and Lang,[6] are tolerably well known. On the contrary, we are quite left in the dark as to the way in which the different organs are formed, what we are to understand by germinal layers in the case of the Cirripedia, &c.

Again, the result of the development within the egg is well-known. The Nauplius-larva, considered by the older observers[7] as a full-grown animal, has been recognised since the discovery of Thompson, as the larval form presented by the Cirripedia when first hatched. A second series of papers treats of the metamorphosis this larva undergoes before reaching the adult state, and compares the development of the Cirripedia with

[1] Kossmann, *loc. cit.*, p. 180.

[2] Thompson, J. V., Discovery of the metamorphosis in the second type of the Cirripedes, viz., the Lepades, completing the natural history of these singular animals, &c., *Phil. Trans.*, 1835.

[3] Filippi, F. de, Ueber die Entwicklung von Dichelaspis darwinii, *Moleschott, Untersuch.*, Bd. ix. 1865.

[4] Münter und Buchholz, Ueber Balanus improvisus, Darw., var. gryphicus, Münter, Abth. 2 *Mittheil. a. d. Naturwiss. Verein. v. Neu-Vorpommern u. Rügen*, i. 1869.

[5] Hoek, P. P. C., Embryologie von Balanus, *Niederländ. Archiv f. Zool.*, Bd. iii. 1876.

[6] Lang, A., Die Dotterfurchung von Balanus, *Jenaische Zeitschr.*, Bd. xii. 1878.

[7] O. F. Müller and others.

that of other Crustaceans which pass through this same larval stage. Since the development of the Copepoda is supposed to be a highly typical one, and since the comparison of these animals with the higher Crustaceans presents no great difficulties, the aim of the researches has been to homologise parts of the body—and especially the appendages—of the Cirripedia with those of the Copepoda. In this department the papers of Claus[1] take the first place. His last publication on the subject appeared in 1876, and in it he proposes the following homologisation of the appendages :—

The first pair of appendages of the Nauplius becomes in Cirripedia, as well as in Copepoda, the first antennæ. In the Cypris-stage of the Cirripedia these antennæ are well-developed, in the full-grown animal only rudimentary.

The second pair of appendages of the Nauplius, which in Copepoda develops into the double-branched second antenna, is cast off by the Cirripedia.

The third pair of appendages (*loc. cit.*, p. 76) in Copepoda changes into the mandibles, and in the development of the Cirripedia is cast off like the second pair (according to Metschnikoff,[2] and v. Willemoes Suhm).[3] According to Claus, it becomes the mandible. If the latter suggestion be right—but it is only supposed and has not been actually observed by Claus—the mandibles of both orders of Crustaceans are homologous.

Behind the third pair, a fourth pair of appendages has appeared. This pair, in the development of the Copepoda, becomes the maxillæ ; in the advanced Nauplius-stage of the Cirripedia a double pair of knobs make their appearance in the same place; from the outside one, according to Claus, the maxillæ may develop, while the other one evidently produces the second maxilla (inner maxilla, Darwin). According to Metschnikoff, the mandibles and the maxillæ of the Cirripedia are together developed from this fourth pair of outgrowths.

As to the following pairs of appendages, the Copepoda will be spoken of first: a fifth pair of appendages has made its appearance behind the fourth; these are the maxillipeds, which, though double-branched, represent only one pair of limbs. Behind the maxillipeds are two new pairs of double-branched outgrowths ; these eventually become the first two pairs of thoracic appendages (paddles, rowing-feet). The fourth and fifth pair of appendages belong to that part of the body, according to Claus,[4] which is covered by the cephalic shield; this seems to prove that he considers the sixth and seventh pair as not being placed under this shield, a suggestion which is, moreover, in accordance with his figure 4 on pl. xix. Neither is the carapace of the full-grown animal truly cephalic, since it also covers the first somite of the thorax; four distinct thoracic somites, each furnished with a pair of appendages, succeed the carapace, and behind this

[1] Claus, C., Die morphologischen Beziehungen der Copepoden, Phyllopoden, Cirripedien, &c., *Würzburger Naturwt. Zeitschr.*, iii. 1862; Die Cypris-ähnliche Larve der Cirripedien und ihre Verwandlung, *Schrift. der Ges. zur Beförd. d. gesammt. Naturw.*, 1869; Untersuchungen zur Erforschung der genealogischen Grundlage des Crustaceen-Systems, Wien, 1876.

[2] *Sitzungsb. der Versamml. deutsch. Naturf. zu Hannover*, 1865, p. 218.

[3] Willemoes Suhm, R. von, On the development of Lepas fascicularis, *Phil. Trans.*, clxvi., 1875.

[4] Untersuchungen, &c., p. 75.

thorax the full-grown Copepod has five abdominal segments, which are not furnished with appendages.[1]

The seven-appendage-stage in the development of the Copepoda Claus calls the Metanauplius-stage. According to him, the Malacostracous Crustaceans pass through the same stage. In the two groups (Copepoda and Malacostraca) the two pairs of antennæ and the mandibles are homologous; the maxillæ and the maxillipeds of the Copepoda are represented in the other group by two pairs of maxillæ; finally, the first two pairs of rowing-feet of the Copepoda correspond to the two pairs of maxillipeds of the Malacostraca.

Let us now return to the comparison of the Copepoda with the Cirripedia. Suppose the hypothesis of Claus is correct, then the mandibles develop from the third pair of larval appendages, and the fourth pair produces the maxillæ and also the second maxillæ; the fifth pair of appendages might then, as Pagenstecher[2] supposed, change into the first pair of cirri, in which case the other five pairs of cirri might be considered as homologous with the five thoracic feet of the Copepoda. To accept this supposition, it would, however, be necessary, Claus says, to prove that the fifth Nauplius-appendages could not possibly be lost by the Cirripedia.

If, on the contrary, the fourth pair of appendages develops into the maxillæ, and the fifth pair into the second maxillæ, or if, as seems to be the opinion of Claus, both pairs of maxillæ develop from the fourth pair of appendages, the fifth pair being lost, then the five thoracic feet of the Copepoda must be considered as homologous with the first five pairs of cirri of the Cirripedia. Finally, Claus is inclined to suppose that the knobs on the genital segment of the Copepoda, which may be shown to be a rudimentary sixth pair of rowing-feet,[3] correspond to the sixth pair of cirri of the Cirripedia. While the highly rudimentary genital knobs of the Copepoda, which ordinarily have totally disappeared, and which, when present, consist merely of a single articulation, are taken into consideration, the so-called caudal appendages of the Cirripedia, which in *Alepas, e.g.*, are eight-jointed, and which must be considered as a branch of a rudimentary seventh cirrus (Gerstaecker), are totally ignored. In conclusion, Claus says, that it does not matter much whether the one or the other hypothesis (viz., that of Pagenstecher or his own) proves to be true; they are of equal value for the main question, for in both the body of the Cirripedia is directly compared with the body of the Copepoda, and both hypotheses acknowledge the same appendages and the same segments for the body of Copepoda and Cirripedia. When both hypotheses can be true, of course they may both be false also. As long as neither of them is based on directly observed facts, the

[1] Claus. Lehrb. d. Zool., 4th Aufl., 1880, p. 544.

[2] Pagenstecher, Beitrag Zur Anat., &c., *Zeitschr. f. wiss. Zool.*, Bd. xiii., 1863.

[3] "Welcher nachweisbar ein rückgebildetes sechstes Ruderfusspaar ist" Claus says (Geneal. Grundl., p. 82). It is indeed curious that such a very interesting detail can be proved, yet never has been. In his classical monograph on the free-living Copepoda (Marburg, 1863), when describing the appendages of the body, the genital nobs are not mentioned at all, and in his Lehrbuch (4th Aufl., 1880) the same appendages are passed over in silence.

comparison of the two groups is a totally hypothetical one. At present this comparison is based upon the homology of the appendages, which homology is as yet quite uncertain.

Taking into consideration that the metamorphosis of the third and the fourth pairs of appendages of the Nauplius-larva into the mandibles and into the maxillæ has not been observed, and attaching more importance to the observations of Metschnikoff and v. Willemoes Suhm, who contend that the third pair of appendages has been lost, the latter saying, moreover, that the three pairs of gnathites are new formations;[1] considering, besides, that there is in most genera of Cirripedia a very distinct separation between the first and the second pair of cirri, the first standing very close to the mouth, and being of a very characteristic form, the latter being much more like the four remaining pairs,—I feel inclined to propose a comparison totally different from that of Claus. There are in a full-grown Cirriped three pairs of gnathites, and originally each of them represents a pair of appendages belonging to a distinct segment of the body. These appendages appear after the metamorphosis into the Cypris-larva has taken place, and then are placed between the three pairs of true Nauplius-appendages, and the so-called fourth pair of Claus.[2] This latter pair, is then really the seventh pair, and develops into the first pair of cirri. Not only in that case would this first pair of cirri correspond to the second pair of rowing-feet of the Copepoda, but we should also have in that part of the Cirriped-body, which in the adult is placed before the second pair of cirri, a part corresponding to the Metanauplius of the Copepoda. The five remaining pairs of cirri are —like the gnathites—not visible in the Nauplius-stage, when studied immediately before the metamorphosis into the Cypris-stage. They represent the appendages of the eighth to the twelfth segments of the body, and therefore may be considered as homologous with the thoracic feet of the Malacostraca. The abdomen of the full-grown Cirripedia is rudimentary; the only pair of appendages of this division is the pair of caudal appendages.

Though I believe that my hypothesis in many respects is more in accordance with the facts than that of Claus, yet in one point it is quite similar, viz., that it is based on the premise that the Nauplius-larva of a Cirriped and of a Copepod are homologous. This premise is so generally admitted that it seems almost ridiculous to doubt its truth. Yet we must not forget that the conformity of the two larval forms is by no means complete. The so-called "frontal threads" of the Cirriped-Nauplius are wanting in that of the Copepoda; the shell glands (antennal glands) of the second pair of appendages of the

[1] If the second pair of appendages has been lost, there is no reason why the third pair should not have shared the same fate. Of course in that case the mandibles of Copepoda and Cirripedia are not homologous parts; but I believe even Claus (*loc. cit.*, p. 81) does not attach, *a priori*, so much importance to this homology, as to accept it so long as it has not been proved by facts.

[2] The three pairs of gnathites are placed so close to one another as to appear to be attached to the same segment of the body. This, however, cannot be the original condition, and is to be considered as a falsification, in consequence of an abbreviation of the developmental process.

Copepoda (Grobben) are never observed in the Nauplius of the Cirripedia; the lateral horns and the very complicated system of dermal glands of the latter are again wanting in the Copepod-Nauplius. The various spinous processes of the Cirriped-Nauplius in the larva of the Copepoda are sought for in vain. No doubt a great many of these differences may be caused by adaptive changes, and be considered as secondarily acquired protective organs, as Balfour[1] calls them—yet this is also a supposition of a somewhat speculative character.

Moreover, we must not lose sight of the fact that it will always be very difficult to explain why the Cypris-stage, so highly characteristic of the ontogeny of the Cirripedia, is totally wanting in the development of the Copepoda, and why, when we consider an Archiphyllopod as the common ancestor of both groups, the Copepoda, which are developed from it in a much more direct way, should be unisexual, whereas the Cirripedia, as a rule, are hermaphrodite. Claus himself has pointed out this latter difficulty,[2] and tries to explain it by submitting that the hermaphroditism of the Cirripedia is of a secondary character. This supposition in the first place is based on the fact that the Cirripedia are not exclusively hermaphrodite, and in the second place, that in those cases in which unisexuality is observed in the group of the Cirripedia, it occurs in a stage which corresponds to the Cypris-stage of the ordinary development; a younger stage corresponding to an earlier period of the phylogenetic development. As this latter conjecture is based in the first place on the sexual relations of the different forms of *Scalpellum*, with which I shall have ample occasion to deal when describing the numerous species of that genus collected during the cruise of H.M.S. Challenger, a discussion of this point may be postponed till then.

An elaborate discussion of what had been published on the so-called Cirripedia Suctoria, or Rhizocephala, does not lie within the province of this Report. As not a single specimen of a *Sacculina* or a *Peltogaster* is to be found in the Challenger collection handed over to me, and as my inquiries of the gentlemen engaged in preparing reports on the Crustacea Podophthalmata, Brachyura, Anomura, &c.—the animals on which the parasitic Cirripedia are found living—have proved in vain, it seems that not a single representative of this group was taken during the cruise of H.M.S. Challenger.[3] Considering that Prof. Semper, during his stay in the Philippine Archipelago, collected nineteen different species of this group, it seems rather curious that not a single specimen was taken by the Challenger. The only way to explain it would be, that the Crustaceans living in shallow water in the neighbourhood of the coast are not very richly represented in the Challenger collection, and that the Cirripedia Suctoria at present known were taken, almost without an exception, from such shallow-water inhabitants.

[1] Balfour, Larval Forms, *Quart. Journ. Micr. Sci.*, vol. xx. p. 381, 1880.

[2] Claus, Genealogische Grundlage., p. 90, *et seq.*

[3] See note by the Editor of the Reports, p. 19.

However, it would be rather premature to draw the conclusion that the Crustacea Podophthalmata of the deep-sea do not suffer from parasitic Cirripedia.

Although Cavolini[1] (1787) published recognisable figures of the full-grown animals, and of the larva, and also showed the great resemblance of these larvæ to those of *Cyclops;* though different forms of these curious parasites were known long before 1854, from the papers of Rathke[2] and others;[3] though Thompson,[4] in 1836, speaks of a concealed affinity between these parasites and the Cirripedia, Darwin, as their true Cirripedial nature was not yet proved, could not take notice of them in his Monograph. Steenstrup[5] (1854) and Lindström[6] (1855) were, after Thompson, the first who suggested in their papers the relation of these parasites with the Cirripedia; but Lilljeborg[7] (1861) no doubt has the merit of having been the first to base this relation on anatomical grounds. Fritz Müller[8] (1863) (in the case of *Lernæodiscus* and *Peltogaster*) then showed that the second larval form of these parasites in almost every respect corresponds to the Cypris-larva of the Cirripedia, and though the same stage for *Sacculina* has not yet been observed, since his discovery the affinity of these highly degenerated parasites with the true Cirripedia has no longer been doubted. Lilljeborg regards them as true Cirripedia, and proposes for them the name of Cirripedia Suctoria. Fritz Müller, on the contrary, wishes to consider them as a distinct order of Crustaceans, which he calls the Rhizocephala, and which form an equivalent group to the nearly related Cirripedia. Since then our knowledge of these aberrant forms has not much increased. A large number of species has been added to those known to Lilljeborg, and the number of genera has also been considerably augmented.[9] The most important contribution to our knowledge of the anatomy of these curious parasites is contained in the papers of Kossmann. I have already pointed out (page 13) that this author considers *Anelasma squalicola* to be a link uniting the Cirripedia Suctoria with the true Cirripedia Thoracica—a view which I think requires confirmation by exact observation.

In 1865, Prof. H. de Lacaze-Duthiers published a provisional description of a parasitic animal of the Crustacean class, which he called *Laura gerardiæ,* and which was considered by him to belong to the Cirripedia.[10] On this same animal an elaborate memoir was published by the same author in 1882.[11] This very interesting parasite

[1] Cavolini, F., Memoria sulla generazione dei Pesci e dei Granchi, Napoli, 1787.

[2] Rathke, *Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur.*, xx. p. 244, 1843?

[3] Diesing, Kröyer.

[4] Thompson, J. V., *The Entomological Magazine*, iii. 1836.

[5] Steenstrup, J. J., Bemaerkninger om Slaegterne Pachybdella, Dies. og Peltogaster, Rathke, *Oversigt o. d. K. D. Vid. Selsk. Forhandl.*, 1854.

[6] Lindström, G., Om larven til en art af Slägtet Peltogaster, *Öfversigt k. Vetensk.-Akad. Förhandl.*, 1855.

[7] Lilljeborg, W., Les genre Liriope et Peltogaster, Upsala, 1859–60.

[8] Müller, Fr., Die zweite Entwickelungstufe der Wurzelkrebse, *Archiv f. Naturgesch.*, Jahrg. xxix. 1863.

[9] So by the papers of Anderson (*Ann. and Mag. Nat. Hist.*, ser. 3, vol. ix., 1862), Semper (*Zeitschr. f. wiss. Zool.*, Bd. xiii., 1863), M. Sars (*Nyt Magaz. f. Naturvid.*, xvii., 1870), Kossmann (*Arbeit. zool. zoot. Instit. Würzburg*, i., 1872–74), Richiardi (*Atti. d. Socist Tosc. d. Scienz. Natural.*, i., 1874), G. O. Sars (*Arch. f. Math. og Naturvid.*, iv., 1880), and others.

[10] *Comptes rendus*, t. lxi., 1865.

[11] Histoire de la Laura Gerardiæ, *Mém. Acad. Sci. Paris*, t. xlii., Paris, 1882.

diverges in many respects from the typical structure of Cirripeds; yet, though perhaps a certain resemblance with some of the parasitic Isopoda is not to be denied, it would be hazardous, contrary to the authority of de Lacaze-Duthiers, to doubt its Cirripedial nature. The points in which it differs from the true Cirripedia are the following:—

1. The shell (carapace, test) has a very remarkable form, which perhaps slightly resembles that of the true parasitic Cirripedia (*Sacculina*, &c.). It almost entirely envelops the body, leaving only a very small aperture, and consists of a cartilaginous outer and a soft inner layer. Between the two layers the female genital organs and the liver are situated.

2. The extremities are one-branched, and bear a very remarkable relation to the genital organs; the oviducts open at the base of the first pair; the testes are placed in the four following pairs of limbs, and open at the basal joint of each leg with a distinct aperture. The sixth pair is short, and has nothing to do with the genital organs.

3. The structure of the head, with its small antennæ, and the parts of the mouth united to compose the "calotte céphalique." The latter forms a suctorial apparatus, which, however, according to Lacaze-Duthiers, is rudimentary in the adult animal.

4. The absence of the organs of respiration, and the high development of the circulatory apparatus.

5. Also the way in which the adult animal takes its food; the shell is overgrown by a polype (*Gerardia*), and the *Laura* sucks its food by means of ramifications of the capillaries which are spread through the shell, and which penetrate with countless roots the tissue of the polype.

6. Finally, the structure of the abdomen, which is distinctly segmented, the hindermost segment terminating in two anal appendices (pièces anales).

Lacaze-Duthiers proposes for this curious parasitic Crustacean a distinct group in the sub-order of the abnormal Cirripedia, which he calls the Ascothoracida or Rhizothoracida. No doubt the mutual relations of these abnormal Cirripedia with each other, as well as with the Cirripedia Thoracica, are still very imperfectly known, and new investigations are necessary.

NOTE ON THE RHIZOCEPHALA.

The naturalists of the Expedition have recorded the occurrence of *Peltogaster* in their Station Books and Journals several times during the cruise, viz.:—Station 158, March 7, 1874; lat. 50° 1′ S., long. 123° 4′ E.; 1800 fathoms; south of Australia, one specimen in the pouch of *Hymenaster*. On this specimen R. v. Willemoes Suhm has the following note:—"In the cavity of a *Hymenaster* which came up to-day there was a parasitic Rhizocephalid, showing a large sucker and a flat body filled with eggs. I could not find any anus, and am not

quite sure to which genus this animal has to be referred; but I think that it is nearest to *Clistosaccus*, Lillj., the only Rhizocephalid in which there is no anus. According to Gerstaecker, Peltogastridæ have only been found on the abdomen of Decapoda, from which this specimen might probably have been detached and fallen into the open breeding-cavity of the *Hymenaster*."

Station 200, October 23, 1874; lat. 6° 48′ N., long. 122° 25′ E.; Basilan Straits, Philippines, 255 fathoms. Two specimens of *Peltogaster* on Caridid shrimps.

Station 214, February 10, 1875; lat. 4° 33′ N., long. 127° 6′ E.; off Meangis Islands, 500 fathoms. One specimen of *Peltogaster* on Ophiurid. On this specimen R. v. Willemoes Suhm remarks:—"Near the mouth of an Ophiurid I found a large tumour, and inside a *Bopyrus* or *Peltogaster* inflated with eggs."

J. M.

I.—GEOGRAPHICAL AND BATHYMETRICAL DISTRIBUTION.

The following list contains the species collected during the cruise of H.M.S. Challenger, and the ranges of depth at which they occurred :—

Name of Species.	Depth at which Dredged.
Lepas anatifera, Linn.	Floating.
hillii, Leach, sp.,	,,
anserifera, Linn.	,,
pectinata, Spengler,	,,
australis, Darwin,	,,
fascicularis, Ellis and Solander,	,,
Conchoderma virgatum, Spengler, sp.,	,,
virgatum, var. *chelonophilum*, Leach,	,,
Balanus tintinnabulum, Linn. sp., var. *spinosus* (Gmelin),	,,
Tetraclita rosea, Krauss, sp.,	,,
Coronula diadema, Linn. sp.,	,,
Chthamalus challengeri, n. sp.,	,,
Balanus lævis, Brug.,	5–15 fathoms.
Tetraclita cœrulescens, Spengler, sp.,	10 ,,
Balanus tintinnabulum, Linn. sp.,	7–20 ,,
Chthamalus dentatus, Krauss,	7–20 ,,
Acasta fenestrata, Darwin,	18 ,,
Balanus trigonus, Darwin,	6–80 ,,
socialis, n. sp.,	28 ,,
amaryllis, Darwin,	8–80 ,,
rostratus, n. sp.,	8–80 ,,
Scalpellum trispinosum, n. sp.,	82–102 ,,
Balanus tenuis, n. sp.,	100 ,,
Scalpellum africanum, n. sp.,	100 ,,
rubrum, n. sp.,	100–115 ,,
Megalasma striatum, n. gen. and sp.,	100–115 ,,
Scalpellum balanoides, n. sp.,	129 ,,
indicum, n. sp.,	129 ,,
Balanus corolliformis, n. sp.,	150 ,,
Scalpellum pedunculatum, n. sp.,	150 ,,
recurvirostrum, n. sp.,	150 ,,
stroemii, Sars,	83-516 ,,
Pœcilasma carinatum, n. sp.,	390–420 ,,

Name of Species.	Depth at which Dredged.
Pœcilasma gracile, n. sp.,	410 fathoms.
Alepas pedunculata, n. sp.,	410 „
Verruca nitida, n. sp.,	500 „
Scalpellum album, n. sp.,	500 „
tritonis, n. sp.,	516 „
Balanus hirsutus, n. sp.,	516 „
Scalpellum nymphocola, n. sp.,	540 „
japonicum, n. sp.,	565 „
Verruca sulcata, n. sp.,	520–630 „
Scalpellum acutum, n. sp.,	520–630–1000 „
parallelogramma, n. sp.,	600 „
triangulare, n. sp.,	600 „
intermedium, n. sp.,	410–700 „
novæ-zelandiæ, n. sp.,	700 „
hirsutum, n. sp.,	825 „
eximium, n. sp.,	1000 „
carinatum, n. sp.,	1000 „
elongatum, n. sp.,	410–1000 „
Dichelaspis sessilis, n. sp.,	1000 „
Verruca gibbosa, n. sp.,	1050 „
Scalpellum distinctum, n. sp.,	1070 „
flavum, n. sp.,	1375 „
tenue, n. sp.,	1375 „
vitreum, n. sp.,	1375 „
dubium, n. sp.,	1400 „
australicum, n. sp.,	1400 „
truncatum, n. sp.,	1400 „
moluccanum, n. sp.,	1425 „
velutinum, n. sp.,	1425 „
Verruca incerta, n. sp.,	1425 „
Scalpellum minutum, n. sp.,	1450 „
insigne, n. sp.,	1525 „
Verruca obliqua, n. sp.,	1525 „
Scalpellum brevecarinatum, n. sp.,	1600 „
antarcticum, n. sp.,	1675 „
Verruca quadrangularis, n. sp.,	1900 „
Scalpellum marginatum, n. sp.,	2000 „
ovatum, n. sp.,	2000 „
Scalpellum gigas, n. sp.,	2050 „
abyssicola, n. sp.,	2050 „
compressum, n. sp.,	2150 „
darwinii, n. sp.,	2160 „
planum, n. sp.,	2600 „
regium (Wyv. Thoms.), n. sp.,	2750–2850 „
regium, var. *ovale*,	2850 „

This list may be condensed into the following table, showing approximately how many times Cirripedia were dredged at certain depths.

Twelve species were taken at the surface.[1]

From dredgings in depths of from	0 to 500	fathoms	21	times.
,, ,, ,,	500 to 1000	,,	13	,,
,, ,, ,,	1000 to 1500	,,	8	,,
,, ,, ,,	1500 to 2000	,,	5	,,
,, ,, ,,	2000 to 2500	,,	3	,,
,, ,, ,,	2500 to 3000	,,	3	,,
,, ,, ,,	3000 to 4575	,,	0	,,

As the exploration of the coasts of islands and continents was of secondary importance during the cruise of H.M.S. Challenger, we need not wonder that the Cirripedia of these regions are badly represented in the collections made during the voyage. Only occasionally were specimens collected in the neighbourhood of the coasts. At the same time this explains how it is that only a small percentage of the specimens collected belong to species described before: out of seventy-eight forms represented in the collection, nineteen only have been previously described, and fifty-nine are named and described here for the first time.

In 1854, Darwin[2] said "the number of known existing Cirripeds is 147." Since that date this number has only slightly increased. I am only aware of eighteen new species, but, as I have already said above, I am far from certain that I have brought together all the information which might be had from zoological literature. There can be little doubt, however, that this number is inconsiderable in comparison with the number Darwin knew when composing his Monograph, and also in comparison with that added during the cruise of H.M.S. Challenger. Hence I thought it would be of little use to prepare a list of all the species known at present, as I did in my Report on the Pycnogonida, in imitation of what Mr. Davidson had done for the Brachiopoda. I merely insert in the following table a list of the genera at present known, giving in separate columns the number of species known to Mr. Darwin, described since the publication of his Monograph, and collected during the cruise of H.M.S. Challenger. One of the columns gives in fathoms the hitherto ascertained depth of each genus.

We learn from this list that out of thirty-four genera of Cirripedia at present known, twenty-eight have never been observed at a depth greater than 150 fathoms. Two have been found from the shore to 400 fathoms (*Alepas* and *Pœcilasma*); *Balanus* occurs from the shore down to 510 fathoms; *Dichelaspis* ranges down to 1000 fathoms, and finally, only

[1] Some of them in numerous places—as, for instance, *Lepas anatifera*—others only once; so *Balanus tintinnabulum*, var. *spinosus*, taken from the screw of H.M.S. Challenger at St. Vincent.

[2] *Loc. cit.*, p. 166.

two genera have been hitherto observed at depths greater than 1000 fathoms, viz., *Scalpellum* and *Verruca*. The list shows very clearly that there are no deep-sea genera, for even of the two genera ranging lowest in depth, species are known from shallow water.

Name of the Genus.	Number of Species according to Mr. Darwin.	Number of Species described 1853–1883.	Number of new Species collected during Cruise of H.M.S. Challenger.	Range in Depth.	Name of the Authors who named the new Species.
Lepas, Linnæus,	6	...	...	Surface.	...
Pœcilasma, Darwin,	5	...	2	Unknown–420 fms.	Hoek.
Dichelaspis, Darwin,	5	3	1	Unknown–1000 fms.	Filippi, Lessona et Tapparone-Canefri, Macdonald, Hoek.
Megalasma, Hoek,	...	...	1	100–115 fms.	Hoek.
Conchoderma, Olfers,	3	2	...	Surface.	Heller, Dall.
Alepas, S. Rang,	4	...	1	Unknown–410 fms.	Hoek.
Oxynaspis, Darwin,	1	...	...	Unknown.	...
Anelasma, Darwin,	1	...	...	Surface.	...
Alcippe, Hancock,	1	...	...	15–20 fms.	...
Ibla, Leach,	2	...	...	Littoral.	...
Scalpellum, Leach,	6	5	43	15–20–300–2850 fms.	M. Sars; G. O. Sars, Hoek.
Pollicipes, Leach,	6	1	...	Littoral.	Hutton.
Lithotrya, G. B. Sowerby,	6	...	...	Unknown.	...
Cryptophialus, Darwin,	1	...	...	Unknown.	...
Proteolepas, Darwin,	1	...	...	Unknown.	...
Kochlorine, Noll,	...	2	...	Littoral.	...
Balanus, Auctorum,	39	1	5	0–150–516 fms.	F. Müller, Hoek.
Acasta, Leach,	8	...	...	Littoral-18(unknown).	...
Tetraclita, Schumacher,	8	...	...	Littoral–10 fms.	...
Elminius, Leach,	4	2	...	Littoral.	Hutton.
Pyrgoma, Leach,	9	...	...	12–35 fms.	...
Creusia, Leach,	1	...	...	Unknown.	...
Chelonobia, Leach,	3	...	...	Surface.	...
Coronula, Lamarck,	3	...	...	Surface.	...
Platylepas, J. E. Gray,	2	...	...	Surface.	...
Cryptolepas, Dall,	...	1	...	Surface.	Dall.
Tubicinella, Lamarck,	1	...	...	Surface.	...
Xenobalanus, Steenstrup,	1	1	...	Surface.	Steenstrup.
Chthamalus, Ranzani,	8	...	1	Littoral.	...
Chamaesipho, Darwin,	2	...	...	Littoral.	...
Pachylasma, Darwin,	2	...	...	Deep-sea.	Darwin.
Octomeris, G. B. Sowerby,	2	...	...	Littoral.	...
Catophragmus, G. B. Sowerby,	2	...	...	Littoral.	...
Verruca, Schumacher,	4	...	6	7–50–300–1900 fms.	Hoek.

Though unquestionably by far the greater part of the known Cirripedia are shallow-water species, and though some of the species are capable of existing at a considerable variety of depth, as for instance *Scalpellum stroemii*, Sars, found at 83 and also at 516

fathoms, yet it must be granted that the number of true deep-sea species of Cirripedia is very considerable.

There are	17	species	living	at	a depth	of from 500–1000	fathoms.
„	12	„	„	„	„	1000–1500	„
„	7	„	„	„	„	1500–2000	„
„	4	„	„	„	„	2000–2500	„
„	3	„	„	„	„	2500–2850	„

Often two or even three species of Cirripedia were brought up with the same haul of the dredge, as for instance :—

At Station 146.—*Scalpellum tenue, Scalpellum brevecarinatum, Scalpellum flavum.*
„ „ 135.—*Scalpellum eximium, Scalpellum carinatum, Scalpellum elongatum.*
„ „ 184.—*Scalpellum dubium, Scalpellum australicum, Scalpellum truncatum.*
„ „ 150.—*Scalpellum recurvirostrum, Balanus corolliformis.*
„ „ 204.—*Megalasma striatum, Balanus tenuis, Scalpellum rubrum.*
„ „ 214.—*Scalpellum album, Verruca nitida.*

And this seems to prove that there are places where the circumstances are especially favourable to the life of Cirripedia.

The occurrence of *Scalpellum* and *Verruca* in the great depths of the ocean coincides in a striking manner with the palæontological history of these genera. However, I have not been able to identify a single one of the recent species with those described by Darwin, Bosquet, and Reuss, in their palæontological memoirs. The fossil species of *Verruca* resemble much more those of the same genus which at present inhabit shallow water than those occurring at a considerable depth : the latter form together a very characteristic division of the genus. With regard to the genus *Scalpellum*, the fossil forms and those found in the deep sea have no doubt some features in common, yet I failed to ascertain a single instance of specific identity. To a certain extent this fact is explained by the very limited geographical distribution of the different species. With a few exceptions, the species were met with only once. These exceptions are the following :—

Pœcilasma carinatum, n. sp., dredged off Culebra Island (West Indies) and off Ascension Island.

Scalpellum elongatum, n. sp., dredged off Tristan da Cunha and off East Cape (Auckland).

Scalpellum velutinum, n. sp., dredged in the Atlantic Ocean, off Cape St. Vincent, and in lat. 32° 24′ S. long. 13° 5′ W.

Scalpellum stroemii, Sars, dredged south of Halifax and ("Triton" Cruise) north of Scotland.

Scalpellum acutum, n. sp., dredged off Miguel Island (Azores), and off Kermadec Islands (Pacific).

Scalpellum intermedium, n. sp., dredged off Sydney and off East Cape (Auckland).

All the other deep sea species were found only once, or at two Stations close to one another (*Scalpellum regium* at Stations 61 and 63, *Scalpellum brevecarinatum* at Stations 146 and 147). *Scalpellum stroemii*, Sars, is the only known deep-sea species which may be called a common species over a wide area of the North Atlantic. The most interesting instance of a species having a wide range, however, is *Scalpellum acutum*, found near the Azores, and in the Pacific near the Kermadec Islands; at both Stations, however, only a few specimens were taken. *Scalpellum elongatum* seems also to inhabit the Atlantic as well as the Pacific—specimens were collected at a very different longitude but almost exactly at the same latitude south in both oceans; but the specimens of the two Stations are not altogether alike, which may be due not only to the different sizes (ages) of the specimens, but also to specific difference. Of course continued investigations may show that what at present seems to be an exception, in reality must be considered as the rule; but with the knowledge we possess at present, we must arrive at the conclusion that the deep-sea genera have a world-wide range, but that the deep-sea species ordinarily have only a very limited distribution.

There is another fact of a very puzzling nature which presents itself when comparing the fossil forms with those of the deep sea. The eldest known fossil genus is the genus *Pollicipes*, and this genus is not represented at all among the forms living at a considerable depth. Yet it is by no means an extinct genus, being represented by seven living species, some of which have a very wide range. But these seven species are littoral forms, at least it is not recorded that any one of them was found at a depth of even 10 fathoms. Many of the fossil species, of which Darwin alone enumerates 22, were found side by side with species of *Scalpellum*, which proves that the species of the two genera once existed under the same circumstances of temperature, depth, &c. As the circumstances under which the fossil species lived are not known to us, and especially as we do not know at what depth they existed, it is extremely difficult—not to say impossible—to account for the fact that the descendants of one genus live in shallow water and those of the other in deep water; much more difficult, because in each genus the fossil and the living species are specifically distinct. As the species of *Scalpellum* live at very different depths, from the shallow water on the English and French coasts, in the gulf of Naples, &c., down to almost the greatest depths where animal life has been observed, we need not necessarily conclude that the deep-sea forms are those which have representatives in fossil deposits; yet it is true that the majority of the fossil species of *Scalpellum* (all those found in Secondary deposits) have the carina simply bowed and

the umbo at the apex, and that this holds good also for most of the deep-sea species. Hence we may venture to assert that in the case of *Scalpellum* the deep-sea more than the shallow-water forms have preserved the character of the oldest fossil species. The latter (*Scalpellum vulgare*, *Scalpellum ornatum*, *Scalpellum rostratum*, *Scalpellum stroemii*, &c.) have a fossil representative in the *Scalpellum magnum* described by Darwin, and taken from Tertiary strata (lower part of the Coralline Crag, &c.). On the contrary, Darwin, whose thorough knowledge of the whole group and of the affinities of the species we do not undertake to dispute, places the two oldest species of *Pollicipes* (*Pollicipes ooliticus* from the Lower Oolite, and *Pollicipes concinnus* from the Middle Oolite) in the same section of the genus in which he places also five of the six recent species known to him. And these were collected in shallow water! So we see that in one genus the deep sea forms have preserved more archaic characters, in another the shallow water forms. For a more detailed comparison of the living species of *Scalpellum* with the fossil species I refer to the descriptive part of my Report. Before taking leave of the subject, I beg to state that I cannot deny the possibility of future investigations of the deep sea bringing to light species of *Pollicipes* also as inhabitants of those regions, though at present I cannot but attach considerable value to the negative evidence, since the objects are relatively large, and since I could not suggest a reason why they should not have been brought up, if present, as well as the species of *Scalpellum*.

For the most part the species of Cirripedia are found in the neighbourhood of the coast. This is the case not only with all the species known to Darwin—with the exception, of course, of those attached to floating objects—but it is also the case with a great many of the species collected during the cruise of the Challenger; even the greater half of the true deep-sea species living at a depth of 500 fathoms and more, seem to occur only in the neighbourhood of the coasts of islands or continents.

The following species were found at a considerable distance from the coast:—

In the Atlantic Ocean:—

Scalpellum nymphocola, n. sp.
tritonis, n. sp.
insigne, n. sp.
regium (Wyv. Thoms.), n. sp.
triangulare, n. sp.
parallelogramma, n. sp.
Verruca quadrangularis, n. sp.
gibbosa, n. sp.
incerta, n. sp.

In the South Indian Ocean :—

Scalpellum tenue, n. sp.
brevecarinatum, n. sp.
flavum, n. sp.
antarcticum, n. sp.
planum, n. sp.

In the Pacific :—

Scalpellum abyssicola, n. sp.
gigas, n. sp.
darwinii, n. sp.
minutum, n. sp.

With regard to the geographical distribution of the Cirripedia, the four provinces into which Darwin divided the globe must be increased, I think, by two or three others. A new province must be added for the Cirripedia of the southern part of the Indian Ocean, and another for the species of Japan and of the North Pacific. The number of species known as inhabitants of these provinces is not yet very large, but—with a few exceptions only—these species are characteristic of the different regions, at least as far as our knowledge goes. I feel inclined, moreover, to divide the great Atlantic province into a northern and southern half, and as I cannot very well understand the difference in meaning between a province and a sub-province, I propose to consider the sub-province formed by Darwin for the southern extremity of Africa as a province also. So we should have the following eight provinces :—

I.—First or North Atlantic Province: the North Atlantic Ocean, from the Arctic regions to about latitude 10° N. This province embraces the coasts of Europe and North Africa, and of the eastern United States, besides the Mediterranean and the West Indies.

Dichelaspis lowei, Darwin.	Madeira.
darwinii, De Filippi.	Mediterranean.
sessilis, n. sp.	Atlantic.
Pœcilasma aurantium, Darwin.	Madeira.
crassum, Gray, sp.	Madeira.
carinatum, n. sp.	West Indies and (III.).
Alepas minuta, Philippi.	Mediterranean.
parasita, Sander Rang.	Mediterranean, Atlantic.

Alepas cornuta, Darwin.	West Indies.
Oxynaspis celata, Darwin.	Madeira.
Alcippe lampas, Hancock.	Atlantic.
Scalpellum vulgare, Leach.	Mediterranean, Atlantic.
stroemii, Sars.	North Atlantic.
striolatum, G. O. Sars.	North Atlantic.
hamatum, G. O. Sars.	North Atlantic.
angustum, G. O. Sars.	North Atlantic.
cornutum, G. O. Sars.	North Atlantic.
nymphocola, n. sp.	North Atlantic.
tritonis, n. sp.	North Atlantic.
insigne, n. sp.	Atlantic.
acutum, n. sp.	Atlantic and (V.).
regium (Wyv. Thoms.), n. sp.	Atlantic.
regium, var. *ovale*, n. sp.	Atlantic.
velutinum, n. sp.	Atlantic and (III.).
Pollicipes cornucopia, Leach.	Mediterranean, Atlantic.
Lithotrya dorsalis, Sowerby.	West Indies.
Proteolepas bivincta,	West Indies.
Kochlorine hamata, Noll.	Atlantic.
Balanus tintinnabulum, Linn., sp.	Madeira, West Indies, Atlantic (II., III., V.–VIII.).
tulipiformis, Ellis.	Madeira, Mediterranean.
stultus, Darwin.	West Indies (?) (VI.).
calceolus, Ellis.	Mediterranean (II., VI.).
galeatus, Linn., sp.	Atlantic, West Indies.
spongicola, Brown.	Atlantic, Mediterranean, West Indies (II.).
perforatus, Bruguière.	Mediterranean, Atlantic, West Indies (II.).
amphitrite, Darwin.	Mediterranean, West Indies (II., IV.–VII.), Red Sea.
eburneus, Gould.	Atlantic, West Indies.
improvisus, Darwin.	Atlantic (III. VIII.).
porcatus, da Costa.	Atlantic (VII. ?)
crenatus, Bruguière.	Atlantic, Mediterranean, West Indies (II.).
balanoides, Linn., sp.	North Atlantic, Atlantic.

Balanus declivis, Darwin.	West Indies.
hameri, Ascanius, sp.	North Atlantic, Atlantic.
hirsutus n. sp.,	Faröe Channel.
Acasta spongites, Poli, sp.	Mediterranean, Atlantic (II.).
cyathus, Darwin.	Madeira, West Indies.
Tetraclita porosa, Gmelin, sp.	West Indies (III.).
radiata, de Blainville, sp.	West Indies (V.).
Pyrgoma anglicum, Sowerby.	Mediterranean, Atlantic.
stokesii, Gray, sp.	West Indies.
cancellatum, Leach.	West Indies ?
Creusia spinulosa, Leach.	West Indies (VI., VII.), Red Sea.
Chthamalus stellatus, Poli, sp.	Atlantic, Mediterranean, Madeira, West Indies (III., VI.–VIII.).
dentatus, Krauss.	Cape Verde Is., West Indies (?) (II.).
Pachylasma giganteum, Philippi, sp.	Mediterranean.
Catophragmus imbricatus, Sowerby.	West Indies.
Verruca strömia, O. F. Müller, sp.	Atlantic, Red Sea.
spengleri, Darwin.	Madeira.
nexa, Darwin.	West Indies.
obliqua, n. sp.	North Atlantic.

II.—Second or African Province, south of latitude 10° N.

Scalpellum ornatum, Gray, sp.	Algoa Bay.
Kochlorine bihamata, Noll.	Cape of Good Hope.
Balanus tintinnabulum, Linn., sp.	Cape of Good Hope (I., III., V.–VIII.).
capensis, Ellis.	Cape of Good Hope, Algoa Bay.
spongicola, Brown.	Cape of Good Hope (I.).
amphitrite, Darwin.	Gambia River (I., IV.–VII.).
perforatus, Bruguière.	Western Africa southward to Loanda (I.).
crenatus, Bruguière.	Cape of Good Hope (I.).
Acasta spongites, Poli, sp.	Cape of Good Hope (I.).
Tetraclita serrata, Darwin.	Cape of Good Hope, Algoa Bay.
rosea, Krauss, sp.	South Africa (V.).
Chthamalus dentatus, Krauss.	South Africa (I., West Indies ?).
Octomeris angulosa, Sowerby.	Cape of Good Hope, Algoa Bay.

III.—Third or South Atlantic Province, embracing the South Atlantic Ocean, from latitude 10° N. to the Antarctic regions; east coast of South America.

Scalpellum velutinum, n. sp.	South Atlantic and (I.).
eximium, n. sp.	South Atlantic.
carinatum, n. sp.	South Atlantic.
elongatum, n. sp.	South Atlantic and (V.).
parallelogramma, n. sp.	South Atlantic.
triangulare, n. sp.	South Atlantic.
africanum, n. sp.	Nightingale Island, Tristan da Cunha.
Pœcilasma carinatum, n. sp.	South Atlantic and (I.).
Balanus tintinnabulum, Linn., sp.	South Atlantic and (I., II., V.–VIII.).
improvisus, Darwin.	Rio Plata, Southern Patagonia (I., VIII.).
armatus, Fr. Müller.	Desterro.
lævis, Bruguière.	Falkland Islands, Straits of Magellan (VIII).
psittacus, Molina, sp.	Patagonia and (VIII.).
Tetraclita porosa, Gmelin.	Brazil and (I., West Indies).
Elminius kingii, Gray.	Falkland Islands and VIII.
Chthamalus stellatus, Poli, sp.	Brazil, Rio Plata (I., VI.–VIII.).
scabrosus, Darwin.	Falkland Islands (VIII.).
Verruca quadrangularis, n. sp.	South Atlantic.
gibbosa, n. sp.	South Atlantic.
lævigata, Sowerby.	Eastern Patagonia (VIII.).
incerta, n. sp.	South Atlantic.

IV.—Fourth or South Indian Province, embracing the southern region of the Indian Ocean.

Scalpellum brevecarinatum, n. sp.	Between the Crozets and Prince Edward Island.
flavum, n. sp.	Between the Crozets and Prince Edward Island.
tenue, n. sp.	Between the Crozets and Prince Edward Island.
antarcticum, n. sp. .	Near South Polar circle.
recurvirostrum, n. sp.	Between Kerguelen and Heard Islands.
planum, n. sp.	South of Australia.

Balanus amphitrite, Darwin	Madagascar (I., V.–VII).
corolliformis, n. sp.	Between Kerguelen and Heard Islands.
Tetraclita serrata, Darwin.	Algoa Bay (II.).
rosea, Krauss, sp.	Algoa Bay (V.).

V.—Fifth or Australian Province, including New Zealand.

Pœcilasma gracile, n. sp.	Off Sydney.
Dichelaspis neptuni, Macdonald, sp.	Australia, Islands of the South-Western Pacific.
Alepas tubulosa, Quoy and Gaimard.	New Zealand.
pedunculata, n. sp.	Off Sydney.
Ibla quadrivalvis, Cuvier, sp.	South Australia.
Scalpellum peronii, Gray, sp.	Swan River, Bass Straits.
acutum, n. sp.	Off Kermadec Islands and (I.).
elongatum, n. sp.	Off Auckland and (III.).
pedunculatum, n. sp.	Off New Zealand.
intermedium, n. sp.	Off Sydney and off Auckland.
novæ-zelandiæ, n. sp.	Off Auckland.
Pollicipes spinosus, Quoy and Gaimard, sp.	New Zealand.
sertus, Darwin.	New Zealand.
darwinii, Hutton.	New Zealand.
Lithotrya cauta, Darwin.	New South Wales.
Balanus tintinnabulum, Linn., sp.	Sydney (I.–III., VI.–VIII.).
nigrescens, Lamarck.	Swan River, Twofold Bay.
decorus, Darwin.	New Zealand.
trigonus, Darwin.	Sydney, New Zealand (VI.–VIII.).
concavus, Bronn.	(VI., VIII.).
amphitrite, Darwin.	Australia, New Zealand (I., IV., VI., VII.).
amaryllis, Darwin.	Moreton Bay, north-east coast of Australia (VI.–VIII.).
allium, Darwin.	Raine Island, Barrier Reef.
vestitus, Darwin.	New Zealand, New South Wales.
imperator, Darwin.	New South Wales, Sydney, Moreton Bay, &c.
Acasta sulcata, Lamarck.	Sydney, New South Wales, South and West Australia.

Acasta glans, Lamarck.	New South Wales, Southern Australia.
Tetraclita porosa, Gmelin, sp.	East coast of Australia (I., III., VI.–VIII.).
rosea, Krauss, sp.	New South Wales, &c. (IV.).
purpurescens, Wood, sp.	Australia, Van Diemens Land, New Zealand (VII.).
vitiata, Darwin.	Raine Island, Barrier Reef (VI.).
radiata, de Blainville, sp.	New South Wales (I.).
Elminius plicatus, Gray.	New Zealand, New South Wales.
simplex, Darwin.	New South Wales, Van Diemens Land.
modestus, Darwin.	New South Wales, Van Diemens Land, New Zealand.
sinuatus, Hutton.	New Zealand.
rugosus, Hutton.	New Zealand.
Chthamalus antennatus, Darwin.	New South Wales, Van Diemens Land.
Chamæsipho columna, Spengler, sp.	New South Wales, Tasmania, New Zealand.
Pachylasma aurantiacum, Darwin.	New South Wales.
Catophragmus polymerus, Darwin.	New South Wales, Swan River.
Verruca sulcata, n. sp.	Off Kermadec Island.

VI.—Sixth Province: Indian Archipelago (including the Philippines, Malacca, Borneo, Sumatra, Java, and New Guinea), and eastern coast of India.

Pœcilasma fissum, Darwin.	Philippine Archipelago.
eburneum, Hinds, sp.	New Guinea.
Dichelaspis warwickii, Gray.	Off Borneo.
Megalasma striatum, n. sp.	Off Luzon.
Ibla cumingii, Darwin.	Philippine Archipelago.
Scalpellum villosum, Sowerby.	Eastern Seas.
album, n. sp.	South of Mindanao.
dubium, n. sp.	Between New Guinea and Australia.
trispinosum, n. sp.	Basilan Straits, Philippine Archipelago.
australicum, n. sp.	Between New Guinea and Australia.
rubrum, n. sp.	Off Luzon.
truncatum, n. sp.	Between New Guinea and Australia

Scalpellum distinctum, n. sp.	New Britannia Archipelago.
moluccanum, n. sp.	Banda Sea.
balanoides, n. sp.	Banda Sea.
indicum, n. sp.	Banda Sea.
ovatum, n. sp.	North of New Guinea.
marginatum, n. sp.	North of New Guinea.
hirsutum, n. sp.	Moluccan Sea.
compressum, n. sp.	Celebes Sea.
Pollicipes mitella, Linn., sp.	Philippine Archipelago (VII.).
Lithotrya nicobarica, Reinhardt.	Timor, Nicobar Islands.
truncata, Quoy and Gaimard, sp.	Philippine Archipelago (VII.).
Balanus tintinnabulum, Linn. sp.	East Indian Archipelago (I.–III., V., VII., VIII.).
ajax, Darwin.	Philippine Archipelago.
cymbiformis, Darwin.	Near Madras.
navicula, Darwin.	Madras.
stultus, Darwin.	Singapore and (I., West Indies ?).
trigonus, Darwin.	Java, East Indian Archipelago.
concavus, Bronn.	Philippine Archipelago (V., VIII.).
amphitrite, Darwin.	(I., II., IV., V., VII.–VIII.).
patellaris(Gmelin),Spengler.	Bengal, Philippine Archipelago.
amaryllis, Darwin.	East Indian and Philippine Archipelago (V.).
Balanus quadrivittatus, Darwin.	East Indian Archipelago.
socialis, n. sp.	Arafura Sea.
tenuis, n. sp.	Off Luzon.
Acasta lævigata, Gray.	Philippine Archipelago and Red Sea.
fenestrata, Darwin.	Philippine Archipelago.
purpurata, Darwin.	Sumatra, Philippine Archipelago.
sporillus, Darwin.	Sooloo Islands.
Tetraclita porosa, Gmelin, sp.	Philippine Archipelago (I., III., V., VII., VIII.).
costata, Darwin.	Philippine Archipelago.
vitiata, Darwin.	Philippine Archipelago (V.).
coerulescens, Spengler, sp.	Philippine Archipelago (VII).
Pyrgoma grande, Sowerby.	Singapore and East Indian Archipelago.
milleporæ, Darwin.	Philippine Archipelago.

Pyrgoma crenatum, Sowerby.	Philippine Archipelago, Singapore.
monticulariæ, J. S. Gray.	Singapore.
Creusia spinulosa, Leach.	Philippine Archipelago, Singapore (I., VII.).
Chthamalus stellatus, Poli, sp.	Philippine Archipelago (I.–III., VII., VIII.).
intertextus, Darwin.	Philippine Archipelago.
Octomeris brunnea, Darwin.	Philippine Archipelago.
Verruca nitida, n. sp.	South of Mindanao.

VII. Seventh or Pacific Province (including China and Japan).

Pœcilasma kaempferi, Darwin.	Japan.
Dichelaspis warwickii, Gray.	China Sea.
aymonini, Lessona, Tappar.-Canefri.	Japan.
Scalpellum vitreum, n. sp.	Off Yeddo.
japonicum, n. sp.	South of Niphon.
gigas, n. sp.	Pacific Ocean.
abyssicola, n. sp.	Pacific Ocean.
Pollicipes polymerus, Sowerby.	Pacific Ocean and (VIII.).
mitella, Linn., sp.	China Sea and (VI.).
Lithotrya truncata, Quoy and Gaimard, sp.	Friendly Archipelago and (VI.)
Balanus tintinnabulum, Linn., sp.	(I., II., IV.–VII.), China, Galapagos Islands.
trigonus, Darwin.	Japan (V., VI., VIII.).
rostratus, n. sp.	Kobie, Japan.
amphitrite, Darwin.	Pacific Ocean (I., II., IV.–VI.).
amaryllis, Darwin.	Japan (V., VI.).
porcatus, Da Costa.	China ? (I.).
cepa, Darwin.	Japan.
Tetraclita purpurescens, Wood, sp.	China ? (V.).
coerulescens, Spengler, sp.	Pacific (VI.).
porosa, Gmelin, sp.	China, Galapagos Archipelago (I., III., V., VI., VII.).
Creusia spinulosa, Leach.	China (I., VI.).
Chthamalus stellatus, Poli, sp.	Coast of China, Gulf of Corea (I., III., VI., VIII.).

Chthamalus challengeri n. sp.	Japan.
Chamæsipho scutelliformis, Darwin.	"Probably from the seas of China," Darwin.

VIII. Eighth Province: West Coast of North and South America from Behring's Straits to Tierra del Fuego.

Scalpellum darwinii, n. sp.	Between Juan Fernandez and Valparaiso.
minutum, n. sp.	South Pacific.
Pollicipes polymerus, Sowerby.	Upper California and (VII.).
elegans, Lesson.	Coast of Peru, of Mexico, &c.
Cryptophialus minutus, Darwin.	Chonos Archipelago, Southern Chile.
Balanus tintinnabulum, Linn., sp.	Peru, California (I., II., IV.–VII.).
psittacus, Molina, sp.	Peru, Chiloe, Chile, Patagonia.
vinaceus, Darwin.	West Coast of South America.
trigonus, Darwin.	Peru, California (V., VI.).
lævis, Bruguière.	Chile, Peru, California (III.).
concavus, Bronn.	Panama, Peru (V., VI.).
pœcilus, Darwin.	West Coast of South America.
improvisus, Darwin.	Guayaquil, West Columbia (II., III.)
nubilus, Darwin.	California.
glandula, Darwin.	California.
cariosus, Pallas, sp.	Columbia River, Behring's Straits, Kurile Islands.
flosculus, Darwin.	Peru and Chile, Tierra del Fuego.
Tetraclita porosa, Gmelin, sp.	West Columbia, Panama (I., III., V.–VII.).
Elminius kingii, Gray.	Tierra del Fuego (III.).
Chthamalus stellatus, Poli, sp.	Northern California (I., III., VI., VII.).
cirratus, Darwin.	Peru, Chile, Chiloe, Northern Chonos Islands.
scabrosus, Darwin.	Peru, Chile, Chiloe, Tierra del Fuego (IV.).
fissus, Darwin.	California.
hembeli, Conrad, sp.	California.
Verruca lævigata, Sowerby.	Chile, Peru, Tierra del Fuego (III.).

II.—DESCRIPTION OF GENERA AND SPECIES.

Lepas, Linn. (1767).

Darwin enumerates six species belonging to this genus, all of which, as a rule, are found attached to floating objects, dead or alive. No new species of this genus has been proposed since the publication of Darwin's Monograph, nor has our knowledge as to their range been considerably augmented or altered. Five of the known species are found nearly all over the world, the sixth, *Lepas australis*, Darw., inhabiting the whole circumference of the Southern Ocean.

No fossil remains of a species of this genus have hitherto been found; it seems to be absent even from the newer Tertiary and Quaternary deposits. Perhaps this is because the genus has originated since that time. However, it is also possible that the genus existed in previous epochs, but that its attachment to floating objects was not favourable to its being preserved in fossil deposits. The genera of Cirripedia, fossil remains of which have been found as yet, are attached to fixed objects, and often are inhabitants of deep water.

It is by no means always easy to distinguish the species of this genus. From a careful examination, however, I am convinced that the diagnoses as given by Darwin are always sufficient. From these diagnoses I have composed the following table, which, of course, does not include all the variations often very considerably changing the exterior of some of the species.

Lepas.

1. Carina terminating in a flat oblong disc, . . . *Lepas fascicularis*, Ellis and Solander.
2. Carina terminating in a fork.
   - i. Valves furrowed.
     - (*a*) Occludent margin of the scutum arched, protuberant, ... *Lepas anserifera*, Linn.
     - (*b*) Occludent margin close to the ridge from the umbo to the apex, . . . *Lepas pectinata*, Spengler.
   - ii. Valves not furrowed.
     - (*a*) Valves smooth or delicately striated; internal umbonal tooth on the right hand scutum, *Lepas anatifera*, Linn.
     - (*b*) Valves smooth; no internal umbonal teeth on the scuta, ... *Lepas hillii*, Leach, sp.
     - (*c*) Valves smooth, thin, brittle; internal umbonal teeth on both scuta, . . . *Lepas australis*, Darwin.

Lepas anatifera, Linn. (Pl. I. figs. 1, 2).

Lepas anatifera, Linnæus, Systema Naturæ, 1767.
„ „ Darwin, Monograph Lepadidæ, 1851, p. 73.

This species shows considerable variations in size and shape. The largest specimen brought home by the Challenger has a capitulum of 45 mm. in length, whereas the largest observed by Darwin measured 51 mm. (two inches). Among the smaller specimens, those with a barbed carina (Darwin's var. *b.* "*dentata*") are by no means rare; of these the capitulum measures at the utmost 17 mm. None of the specimens are furnished with the diagonal line on scutum and tergum of dark greenish-brown, square, slightly depressed marks, as figured by Darwin (*loc. cit.*, pl. i. fig. 1). Curiously enough, I found the same lines very distinctly developed on the scuta and terga of specimens of *Lepas anserifera*, Linn., from the Pacific Ocean.

This extremely common species was only met with by the Challenger in the Atlantic Ocean. It inhabits the surface, attached to floating timber, vessels, &c. Very large specimens were collected towards the end of 1872, almost before regular observations were commenced. During the cruise itself it was observed at the following localities:—

Near Station 30, April 2, 1873, south of Bermuda. Numerous small and even extremely small specimens attached to a log and to each other. No ova. Carina smooth or barbed as in var. *b.* "*dentata.*" Larvæ in the Cypris-stage are affixed to the larger specimens, and to the surface of the log.

Near Station 74, July 1, 1873, off Fayal, Azores. Small quantity attached to a box. Not quite full-grown. Without ova. Carina smooth. Numerous larvæ in the Cypris-stage among the larger specimens.

Station 75, July 2, 1873, off Fayal, Azores. Two small specimens with a barbed carina; depth 50 to 90 fathoms. Although the specimens came up with the dredge, there can be no doubt but that they were taken at the surface.

Near Station 137, October 24, 1873; lat. 35° 59′ S., long. 1° 26′ E. Attached to a floating spar. Numerous specimens of different sizes; the larger ones with ova.

Cape of Good Hope, November 1873. Numerous specimens of very different sizes (capitulum 5–45 mm.). The larger specimens with ova; taken from a log of wood.

Observations.—A small bottle, labelled Station 244, 2900 fathoms, contains a right-hand scutum with the umbonal tooth. The shell has suffered considerably from the influence of the sea water, yet belongs doubtlessly to the present species.

Lepas hillii, Leach, sp. (Pl. I. fig. 3).

Pentalasmis hillii, Leach, Tuckey's Congo Exped., 1818, p. 413.
Lepas hillii, Darwin, Monograph Lepadidæ, 1851, p. 77.

Two young specimens of this species were taken from the screw of the Challenger at St. Vincent, Cape de Verde Islands, in April 1876, when on her return homewards.

Though young specimens, they agree in all essential regards with the diagnosis and description of Darwin. Two nearly full-grown specimens were taken from the screw in September 1875, in the Pacific Ocean, about Station 269. The fork of the carina is deeply embedded; the uppermost part of the peduncle has lost its orange colour, which may be due to the alcohol. Nor did I observe the yellowish beads on the chitinous membrane at the base of the capitulum, as described by Darwin. As stated by this author the filamentary appendages offer a good character, so I give, on Pl. I., figures of the basal articulation of the first cirrus, not only of this but also of the other species of this genus.

Lepas anserifera, Linn. (Pl. I. fig. 4).

Lepas anserifera, Linnæus, Systema Naturæ, 1767.
„ „ Darwin, Monograph Lepadidæ, 1851, p. 81.

On different occasions specimens belonging to this species were collected during the cruise of H.M.S. Challenger. Sometimes only a few, and at the same time small, specimens were collected; but on two occasions numerous and large specimens were taken. The former, probably, are young, while the latter, on the contrary, are full-grown and mature, being moreover frequently furnished with ovigerous lamellæ. As, however, their capitulum is only 23 mm. at the utmost, they have not reached the size of the largest specimen observed by Darwin, which had a capitulum one inch and a half (about 38 mm). in length. In one other respect, some of the larger specimens (collected at Raine Island) do not quite agree with Darwin's diagnosis; their valves are not approximate, but distinct, dark reddish-coloured interspaces being left between the scutum and tergum, and still broader ones between the carina and scutum and tergum. These interspaces do not occur in the smaller specimens, nor in the larger ones collected on the north coast of New Guinea.

The small specimens with approximated valves (Station 192) have a smooth carina; of the larger specimens (collected near Raine Island), the younger ones are furnished with a barbed carina, the eldest and largest ones, on the contrary, with a smooth carina. The small specimens (Station 192) have their occludent margin more rounded and their capitulum less elongated than the larger ones. In all the specimens the ridge running from the umbo to the apex is very distinct. In all the peduncle is extremely short. Those of Station 192, with a capitulum of almost 10 mm., had a peduncle of 3 mm. at the utmost; the larger specimens of Raine Island (capitulum 20 to 23 mm.) have a peduncle of 7 to 9 mm. The peduncle of the former specimens is very deeply embedded in the surface of the branch to which they were found attached. This is also the case with the short peduncle of the full-grown specimens from the north of New Guinea. The specimens of Raine Island are those of which I have already said above (p. 38) that they were

furnished with a line of slight quadrilateral depressions of a dirty brownish colour running diagonally across the capitulum. The line, however, is not a straight one, as in the case of *Lepas anatifera*, but an inflected one, the hollow side being directed towards the aperture of the capitulum.

I give a figure of the filamentary appendages of one of the largest specimens of this species in Pl. I. fig. 4. In the smaller specimens—as Darwin has already observed—the upper pair is represented by small knobs; in the larger specimens I found the most anterior of the upper pair and the lowest posterior pair the largest.

This species was collected:—Atlantic Ocean—May 6, 1876, on Gulfweed. A very small specimen, with the angle formed by the two occludent margins of the tergum larger still than 90°. South of Bermuda, surface. One small specimen attached to Gulfweed. Pacific Ocean—South-east of Raine Island, August 29, 1872. Numerous young and full-grown specimens. Moluccan Sea, Station 192, September 26, 1874; lat. 5° 42′ S., long. 132° 25′ E. The depth from which the dredge was hauled at this Station was 129 fathoms, but though the branch with the specimens of *Lepas* formed part of its contents, it does not prove that they were actually taken at the bottom. Near Station 217, February 22, 1875, north coast of New Guinea. Numerous specimens floating at the surface. North of the Low Archipelago, between Stations 275 and 276, September 15, 1875. Two small specimens, attached to one another and to a small piece of floating wood. Near Station 276, September 16, 1875, Low Archipelago. Small specimens attached to a floating *Janthina*.

Lepas pectinata, Spengler.

Lepas pectinata, Spengler, Skrifter Naturhist. Selskabet, II., 1793, p. 106, Tab. x. fig. 2.
„ „ Darwin, Monograph Lepadidæ, 1851, p. 85.

The furrowed surface of the specimens collected by the Challenger is very conspicuous; in almost every specimen all the ridges, and more especially that running from the umbo to the apex of each scutum, are covered with prominent calcareous spines.

Numerous specimens of this species were taken swimming at the surface, north of Cape de Verde Islands, on April 28 and 29, 1876. Some of them were taken at night, others by day. They were attached to shells of *Spirula*, and are of a very small size; some of the *Spirula* shells only bear one specimen, which is placed terminally, others are furnished with as many as three or even more specimens, in which case some are affixed terminally, others laterally.

A small piece of a *Spirula* shell was taken at the surface between Sydney and Wellington, the terminal portion of which was occupied by a great number of Cirriped-larvæ in the Cypris-stage. Among them was a small specimen of *Lepas pectinata;* this, as far as my knowledge goes, is the first instance of the species having

been observed in Australia. The latter specimen was taken in June 1874. Whether the Cypris-larvæ belong also to this species I cannot say with certainty; probably, however, they do.

Lepas australis, Darwin.

Lepas australis, Darwin, Monograph Lepadidæ, 1851, p. 89.

An inconsiderable number of specimens of this species were found attached to a piece of *Laminaria* (*Durvillia*?) picked up by the log line in the South Indian Ocean. There are three or four full-grown and numerous young specimens attached to the full-grown ones, and to the surface of the *Laminaria*.

The only difference worth noticing between the specimens described by Darwin and those brought home by the Challenger, consists in the greater size of the latter. Darwin states that his largest specimen has a capitulum of one inch long (25·4 mm.), whereas one of those of the Challenger collection measures no less than 33·6 mm.

The species was taken between Stations 143 and 144, December 22, 1873, lat. 40° S., long. 27° E., on floating sea-weed.

According to Darwin this species is common on *Laminaria* throughout the whole Antarctic Ocean. To this ocean it is confined, as far as our knowledge goes.

Lepas fascicularis, Ellis and Solander (Pl. I. figs. 5–7).

Lepas fascicularis, Ellis and Solander, Zoophytes, 1786, Tab. xv. fig. 5.
„ „ Darwin, Monograph Lepadidæ, 1851, p. 92.

During the cruise of the Challenger from Japan to Sandwich, along the thirty-fifth degree of latitude, great numbers of floating Lepadids were met with. A considerable quantity of these were collected and preserved in spirits. Dr. R. v. Willemoes Suhm (*loc. cit.*, p. 132), recognised in this Barnacle the very variable *Lepas fascicularis*, Ellis and Sol., which was described by Darwin. In his paper, published in the Transactions of the Royal Society, which is chiefly devoted to the development of this species, he enters into the discussion of the question, whether this Pacific form be really identical with the Atlantic form, or must be separated from it as distinct.

According to him, the only differences are seen in the mandibles and the maxillæ. Whereas the ordinary number of the teeth in the mandible is five, in most specimens he dissected there were six. "Sometimes, however, there are five on one side and six on the other, showing that this difference has no constant value." This difference is quite an imaginary one; on Pl. I. fig. 5 I give a figure of the mandible of one of the Pacific specimens of *Lepas fascicularis*. Von Willemoes Suhm would call this a

mandible with six teeth, Darwin, however, one with five teeth and an inferior point, which in this species is rather broad and finely pectinated. To show the correctness of my interpretation one has only to compare the figure of the mandible of *Lepas anatifera* in Darwin's Monograph (Lepadidæ, pl. x. fig. 5) with his description: "mandibles with, as usual, five teeth," &c.; moreover, when giving this description, Darwin refers to the figure in pl. x. According to Darwin, the maxillæ have four regular steps; according to v. Willemoes Suhm, they have sometimes four, and more commonly only three steps, besides the two large unequal upper spines. This difference does really exist, at least if Darwin's description is correct. I always observed only three steps, both in the maxilla of the Challenger specimens, from which Pl. I. fig. 6 is drawn, and also in the maxillæ of one of the specimens collected by the Brothers Krause in the neighbourhood of the Tschuktschen-Peninsula.[1] Von Willemoes Suhm, however, did not always observe the same number, and this shows clearly, I believe, that the importance of this difference is not very great. In the descriptions of the different species of the genus *Lepas*, Darwin, moreover, has given numerous instances of variations in the number of teeth, both in the mandible and in the maxilla. There is another point, however, which at first made me think it necessary also to consider this Pacific form as a distinct variety of the Atlantic one. This is the smoothness, when seen with the naked eye, of the chitinous membrane which covers the valves and fills out the interspaces between them. According to Darwin, this membrane is thickly clothed, especially in the interspaces between the two valves, with minute spines, barely visible to the naked eye. As I said above, the Pacific specimens, when seen with the naked eye, do not show a trace of spines, and only a certain roughness may be distinguished, which is occasioned—as an investigation with the microscope brings to light—by extremely thin and flat threads, which often seem to adhere to the chitinous membrane at more than one point. Often also numerous microscopic Algæ are present at the surface, and contribute not inconsiderably to this roughness. The specimens from the northern coast of Siberia, collected by the Brothers Krause, show exactly the same condition of the surface as the Challenger specimens.[2] In all other regards the Pacific specimens agree entirely with Darwin's description, except in so far as the size is concerned. And this is perhaps the most considerable point of difference between the Pacific and the Atlantic form. The size of the capitulum of the largest specimen does not quite reach 25 mm., whereas the Atlantic specimens often have a length of 40 mm. The large Atlantic specimens, though brittle, have a shell considerably stronger and more calcareous than the smaller specimens.

In the Pacific Ocean about 100 specimens (and often a much more considerable

[1] These specimens belong to the Natural History Museum of Bremen. They were kindly sent me for examination by the Director of the Museum, Dr. Spengel.

[2] In the Atlantic specimens this roughness is not the rule; of late I have been enabled to study specimens from Vineyard-Sound (United States of America), and these show exactly the same condition of the surface as those of the Pacific.

number still) are massed together into large floating balls; smaller (younger) specimens are, as a rule, observed among the larger ones.

The shell of the *Lepas* is often inhabited by an Annelid, as well as by the *Lepas* itself.

The bottles with the *Lepas fascicularis* are labelled July 6, 1875, North Pacific, surface (between Stations 248 and 249).

Great collections of larvæ in the first and in the later Nauplius-stages were made about the same locality in the Pacific.

Pœcilasma, Darwin, 1851.

Darwin founded the genus *Pœcilasma* for those Lepadids with the carina extending only to the basal points of the terga, with nearly oval scuta, having the umbones at the rostral angle, with the lower end of the carina either truncated or produced into a deeply embedded disc.

Gerstaecker (in Bronn, *loc. cit.*, p. 535), moreover, has stated in his description of this genus, that the caudal appendages are uniarticulate and always furnished with bristles, that the mandibles have four teeth, and that the anterior ramus of the second cirrus is not thicker than the posterior ramus.

Darwin describes five species of this genus. As far as my knowledge goes, no new species has been discovered since the appearance of his monograph.

Among the Lepadids of the Challenger I found two different forms which I believe must be considered as species of this genus; only it will be necessary to extend somewhat the generic description as given by Darwin. This, I think, is more in accordance with the principles followed by the author of the monograph of the Cirripedia, than to resolve on the creation of a new genus for every small deviation from the description proposed. Darwin has shown, by placing *Lepas fascicularis*, Ellis, in the genus *Lepas*, as well as by publishing the above copied diagnosis of the genus *Pœcilasma*, that he admits a considerable amount of variation in the shape of the carina within the limits of a single genus. And it is just the shape of that same carina which alone renders it difficult to place the two Challenger forms in the genus *Pœcilasma*. But as these forms in all other regards agree entirely with the generic description, I think this difference of less importance. Both species have the carina neither truncated nor produced into a deeply embedded disc; its two sides are considerably enlarged downwards, making the carina itself much deeper than in any of the other species of the genus (Pl. I. fig. 8; Pl. II. fig. 2). I therefore propose to include within the diagnosis of the genus *Pœcilasma*, Darwin (Hoek), the following description of the carina: the lower end of the carina either truncated or produced into a deeply embedded disc, or keel-shaped and considerably enlarged.

Four out of the five species known to Darwin live attached to Crustacea in the European and eastern warmer temperate and tropical oceans. One of these, *Pœcilasma kaempferi*, was found attached to *Inachus kaempferi*, de Haan (Japan), a crab probably from deep water; another, *Pœcilasma aurantium*, lives attached to *Homola cuvierii*, from Madeira, probably also a deep-water crab (Darwin); the third, *Pœcilasma crassum*, to the same *Homola cuvierii*; the fourth, *Pœcilasma fissum*, was found parasitic on a spinose crab under a stone at low water; the fifth, *Pœcilasma eburneum*, was found attached to broken off spines of an *Echinus* from New Guinea.

Of the two Challenger species, one comes from the Atlantic Ocean, the other from the Pacific; both species were found in the neighbourhood of the coast, and living at a depth of about 400 fathoms, attached to horny Corallines.

Two fossil species of this genus have been described by Reuss.[1] Good figures of the fossil remains are added to his description. The valve which represents the one species is considered by the author to be the carina. But as it does not resemble the carina of any of the known species of *Pœcilasma*, I think there are no reasons for accepting his determination. The other species is represented by a valve which is no doubt a scutum of a Lepadid. But this single valve is by no means sufficient to determine the genus.

The determination of the seven at present known species of the genus will be found easy by means of the following table :—

Pœcilasma, Darwin.[2]

Terga present.

1. Basal angles of the terga cut off.
   - (i.) Carina very narrow.
     - (*a*) Carina with a truncated and crested base, . . . *Pœcilasma kaempferi*, Darwin.
     - (*b*) Carina with a truncated base, ... *Pœcilasma aurantium*, Darwin.
   - (ii.) Carina widens downwards considerably (enlarged).
     - (*a*) Carino-tergal margin of the scutum hollowed out downwards for the widened part of the carina, . . *Pœcilasma carinatum*, n. sp.
     - (*b*) Carino-tergal margin rounded as usual, . . . *Pœcilasma gracile*, n. sp.
2. Basal angles of the terga pointed.
   - (*a*) Scutum not divided into two segments, . . . *Pœcilasma crassum*, Gray, sp.
   - (*b*) Scutum divided into two segments, ... *Pœcilasma fissum*, Darwin,

Terga wanting, ... *Pœcilasma eburneum*, Hinds, sp.

Pœcilasma carinatum, n. sp. (Pl. I. figs. 8–10; Pl. II. fig. 1; Pl. VII. figs. 6, 7).

Valves five; carina considerably enlarged downwards, terminating in an indistinct fork; umbonal teeth of the scutum not very strong; carino-tergal margin concave in the undermost half for the reception of the widened part of the carina; terga with the basal point

[1] Ueber fossile Lepadiden, *Sitzungsb. d. math.-naturw. Cl. d. k. Akad. d. Wiss. Wien*, Bd. xlix. 1864, pp. 215–246, with 3 plates

[2] Darwin regards *Pœcilasma* as feminine, though the Greek word ἴλασμα is neuter.

truncated, almost parallel to the occludent margin. Maxillæ with stronger spines above and slenderer spines beneath the notch, which itself is without spines. Caudal appendages with numerous long bristles on their summits.

General appearance—Capitulum rather compressed, in the largest specimen narrower than in the smaller ones. Fig. 8 (Pl. I.) represents one of the smaller ones. Valves white, almost entirely smooth, when seen with a lens there appear fine striæ radiating from the umbones. Peduncle very short.

Scutum.—Apex pointed, ridge running to the umbo faint; basal margin very short, carino-tergal margin of a curious concave shape, being hollowed out for the reception of the widened part of the carina; angle formed by the basal and the carino-tergal margins very sharp. A very characteristic swelling is described where the scutum and the carina meet near the basal margin. There is no trace of an internal basal rim, and the teeth near the umbo are not very strong. The convexity of both valves is quite equal.

Tergum with the occludent margin straight and the basal angle truncated, almost parallel to the occludent margin.

Carina short, strongly curved, upper part much narrower than the lower part; externally carinated, internally—especially in the undermost part—distinctly concave; the basal and broadest part forms a kind of fork, which is not embedded in the membrane of the peduncle (Pl. VII. fig. 6).

Peduncle very short, about one-eighth the length of the capitulum, indistinctly ringed.

Mouth.—Labrum with a row of very small teeth on the crest and palpi, with a tuft of slender hairs internally. *Mandibles* with four teeth and an inferior apex, which, when seen under the microscope, terminates in three very small points. In the only specimen, the mouth of which I have investigated, the mandible of the right side is formed as figured in Pl. I. fig. 9, that of the left side (Pl. VII. fig. 7) having three teeth only, the fourth forming with the inferior apex a single process terminated by several small teeth. *Maxilla* (Pl. I. fig. 10) with three stronger spines on the upper angle; the notch or depression beneath the angle bears no spines; beneath the depression four slender spines are inserted, the inferior upraised part is armed with a double row of longer and stronger spines. The surface of the maxilla towards the side bearing these spines is furnished with numerous slender hairs, of which, as a rule, two, three, or four, stand close to one another.

Cirri.—Posterior cirri with segments bearing the same number of cirri as in *Pœcilasma kaempferi*, Darwin, viz., five pairs, the lowest pair being very minute; the segments elongated. First cirrus standing not far from the second (Pl. II. fig. 1), rami nearly equal, truncated at the extremity, rather thick. Second cirrus more than twice as long as the first, anterior ramus not thicker, but considerably shorter than the posterior ramus; the difference in the number of segments (18 and 15) being by no means so great as that in the length of the different segments.

Caudal appendages with about one-fourth the length of the pedicel of the posterior cirrus with long bristles at the extremity, and with the sides naked.

Ova.—Long, oval, and pointed, their length (0·26 mm.) being exactly two and a half times their breadth.

Penis clothed with very fine hairs, and bearing a tuft of somewhat stronger ones at the extremity.

Size.—The capitulum of the largest specimen 14 mm. long. This specimen was furnished with ovigerous lamellæ.

This species was collected on two different occasions during the cruise of the Challenger:—Station 24, March 25, 1873, off Culebra Island (West Indies); depth, 390 fathoms; bottom, mud. One small specimen. Station 344, April 3, 1876, off Ascension Island (Atlantic Ocean); depth, 420 fathoms; hard ground. Three specimens and two very small ones, attached to a Coralline.

Pœcilasma gracile, n. sp. (Pl. II. figs. 2–4).

Valves five; carina terminating downwards, neither truncated nor in an embedded disc, but considerably enlarged and keel-shaped. Tergum with the basal point truncated and almost parallel to the occludent margin. Tergo-lateral margin rounded. Notch behind the stronger spines at the upper side of the maxillæ without spines. Caudal appendages with long spines at the extremity.

General appearance.—Capitulum about twice as long as it is broad, compressed. Valves white, distinctly striated.

Scutum with the apex pointed, with a distinct ridge running to the umbo; basal margin equalling the breadth of half the carina near its basal extremity. Carino-tergal margin distinctly divided into a carinal and tergal portion. The carinal portion is convex and rounded, the tergal portion straight. The interior structure of the scutum could not be studied, as I wished to keep the capitulum as a whole.

Tergum basally truncated, flat, oblong, much like that of *Pœcilasma kaempferi*, Darwin.

Carina very narrow and flat at its superior extremity, considerably enlarged downwards and keel-shaped. The dorsal margin runs downwards over the extremity of the peduncle, the base of the carina forming nearly a right angle with the basal margin of the scutum.

Peduncle about one-third of the length of the capitulum.

Mouth.—Labrum (Pl. II. fig. 3) with a row of small teeth on the crest and palpi as in the other species of the genus. The *mandibles* (Pl. II. fig. 4) have four teeth, and the inferior angle terminates in two small points when seen under the microscope. *Maxillæ*

resemble almost exactly those of the foregoing species; beneath the notch there is one slender spine, while numerous stronger spines are inserted in a double row on the inferior upraised part.

Cirri.—Posterior pair with segments bearing as a rule four pairs of spines, the lowest pair of which is very minute, the second pair minute. Dorsally at the limit of two segments, one stronger and two or three smaller spines are inserted. First pair of cirri standing far separated from the second; rami about equal in length and thickness, less than half as long as those of the second cirri. Second cirrus with anterior ramus not thicker and only a trifle shorter than the exterior ramus; the interior has fourteen, the exterior fifteen segments. Both rami of third cirrus have a longitudinal row of slender spines reaching to about the eighth segment.

Caudal appendages about one-fourth of the length of the pedicel of the last cirrus, with a row of slender spines at the extremity.

Penis not very hairy.

Size.—Entire length 8 mm., the capitulum measuring nearly 7 mm.

During the Challenger Expedition one specimen was collected at Station 164A (off Sydney, Australia); lat. 34° 13′ S., long. 151° 38′ E; depth, 410 fathoms; bottom, grey ooze.

Dichelaspis, Darwin, 1851.

Darwin gives the following diagnosis of this genus:—Valves five, generally appearing like seven, from each scutum being divided into two distinct segments, united at the rostral angle; carina generally extending up between the terga, terminating downwards in an embedded disc, or fork, or cup. Mandibles with three or four teeth; maxillæ notched, with the lower part of the edge generally not prominent; anterior ramus of the second cirrus not thicker than the posterior ramus, nor very thickly clothed with spines; caudal appendages uniarticulate, spinose.

As far as the animal's body is concerned, there is no important difference between this genus and *Pœcilasma*. It has been separated by Darwin from the latter genus, "being so easily distinguished externally, that I have thought it a pity to sacrifice it." The characteristic form of the scutum and the carina, which runs up between the terga, make it easy, no doubt, to distinguish this genus from the other Lepadid-genera, to which in other regards it shows great affinity.

Darwin describes five species of this genus. Three species more have since been described. In the first place, *Dichelaspis darwinii*, de Filippi, from the Mediterranean, then *Dichelaspis neptuni*, Macdonald, sp., from Moreton Bay, Australia. This second species has been introduced into science under the name *Paradolepas neptuni*. However there can be no doubt, I believe, but that it belongs also to the present genus. I even

think that it is more nearly related to *Dichelaspis lowei*, Darwin, than any of the other species; it corresponds to this species and to *Dichelaspis darwinii*, Filippi, in the form of the carina. The third species is *Dichelaspis aymonini*, Lessona et Tapparone-Canefri, from Japan. So we have eight species, which all inhabit eastern and western warmer oceans in the northern hemisphere (Madeira, Mediterranean, off Borneo, China Sea, Japan coast, Indian Ocean, &c.). They were found attached to Sea-snakes, Crustaceans, horny Corallines, &c. The individuals of most species seem to be rare, as Darwin suggested. About their bathymetrical distribution almost nothing is known.

To this genus belongs also, I believe, the species before me. It differs from the typical species as described and figured by Darwin in the extent to which the valves are separated from each other, and in the form of the scutum. In both regards the new species is intermediate between *Pœcilasma* and *Dichelaspis*. However, the carina extending up between the terga, and being much bowed, gives it in a striking manner the appearance of the species of *Dichelaspis;* especially to that of *Dichelaspis orthogonia*, Darwin, the present species shows a considerable resemblance.

For the determination of the species known at present, I insert the following table:—

Dichelaspis.

1. Carina terminating in a disk.
   - i. Basal segment of the scutum twice as wide as the occludent segment, ... *Dichelaspis warwickii*, Gray, sp.
   - ii. Basal segment narrower than the occludent segment, ... *Dichelaspis grayii*, Darwin.
   - iii. Basal segment much narrower and about half as long as the occludent segment, . . *Dichelaspis pellucida*, Darwin.
2. Carina terminating in a fork.
   - i. Basal segment of the scutum directed towards the centrum of the capitulum, . . . *Dichelaspis neptuni*, Macdonald, sp.
   - ii. Basal segment of the scutum running parallel to the lower margin of the capitulum.
     - (*a*) Capitulum almost as long as broad.
       - α Tergum triangular, . . . *Dichelaspis aymonini*, Lessona.
       - β Tergum divided by a deep notch, . *Dichelaspis darwinii*, Filippi.
     - (*b*) Capitulum more than once and a half as long as it is broad, . . . *Dichelaspis lowei*, Darwin.
3. Carina terminating in a cup.
   - i. Scutum divided into two distinct segments, . *Dichelaspis orthogonia*, Darwin.
   - ii. Scutum with a notch only and indistinctly divided *Dichelaspis sessilis*, n. sp.

Dichelaspis sessilis, n. sp. (Pl. II. figs. 10–12).

Interspace between the scutum and the two other valves not so considerable as in the other species, the scutum being only indistinctly divided in two segments. Basal segment

short and pointed towards the extremity. Terga triangular, basal angle pointed. Carina terminating downwards in a small cup. Mandibles with four teeth; maxillæ with the inferior part beneath the notch rather prominent. Caudal appendages.

General appearance.—Capitulum much compressed, about twice as long as broad. Valves separated by a very thin membrane, which can be followed over the surface of the valves.

Scutum formed of a rather broad part towards the occludent margin, and a very small and short piece along the basal margin. A not very distinct ridge runs from the apex to the umbo; the surface shows faint traces of radiating lines.

Tergum triangular; two occludent margins, the one long and slightly arched, the other short, meeting the former at a rounded angle; carinal margin almost straight, slightly hollowed a little above the middle; scutal margin nearly straight, meeting the carinal margin at a rather pointed angle.

Carina large and much bowed, extending up between the terga; externally with a flattened central ridge, broad at the superior extremity and tapering towards the point, where the carina is strongly curved inwards. The inferior cup-shaped part I feel unable to describe, as I have not separated this valve from the others, which alone could give full information, but which would have destroyed the specimen. Its external appearance may be judged from the figure (Pl. II. fig. 10).

Peduncle extremely short and rather narrow; its surface being distinctly furrowed at the surface.

Mouth.—Mandibles (Pl. II. fig. 11), with four teeth and the inferior angle bifid. *Maxillæ* (Pl. II. fig. 12), with four spines above the notch, two small ones in the notch, and a double row of spines on the rather prominent inferior part.

Cirri.—First pair far removed from the second pair. Thickness of the rami almost the same; length differing a little, the posterior ramus being two segments longer than the anterior one. Number of segments of both rami of the second pair not very considerable (11 and 12), the posterior one with twelve segments being the longer. Segments as a rule furnished with four or five pairs of spines, the first pair of each segment being much smaller than the following ones. The inferior segments, moreover, are furnished with a longitudinal row of small spines always transversely directed. The inferior segments of the rami of the sixth cirrus are furnished with six pairs of spines, the superior ones with five, the last segments with even fewer pairs.

Caudal appendages.—Thin, narrow, about half as long as the pedicels of the sixth cirrus; a tuft of long bristles, reaching farther still than the extremity of the pedicels, on the summit.

Penis slightly hairy on the inferior part, the superior part wanting.

Size, $7\frac{1}{2}$ mm.

The only specimen brought home by the Challenger is attached to the spine of an Echinid, and was dredged in the Atlantic,—near the Azores, at Station 73, June 30, 1873; lat. 38° 30′ N., long. 31° 14′ W.; depth, 1000 fathoms; bottom temperature, 3°·7 C.; bottom, Globigerina ooze.

Observations.—*Dichelaspis sessilis* is the first instance of a *Dichelaspis* dredged up from a considerable depth. Two other species, however (*Dichelaspis lowei* and *Dichelaspis warwickii*), were found attached to crabs, which may or may not have been inhabitants of deep water. One species, *Dichelaspis orthogonia*, habitat unknown, was found "apparently" attached to a horny Coralline, which perhaps was procured from a considerable depth. Two species were found attached to the skin of sea-snakes, and, therefore, may be considered as surface-animals.

N.B.—Small specimens of a Foraminifer (*Discorbina* ?) were found attached to the capitulum of *Dichelaspis sessilis*.

Megalasma, n. gen.[1]

Valves five, approximate; carina extending only to the basal points of the terga, with its lower end truncated and very wide. Scuta triangular, with their umbones at a considerable distance from the rostral angle. Mandibles with four teeth; maxillæ slightly notched, with the lower part of the edge slightly prominent; anterior ramus of the first cirrus much thicker than the posterior ramus; the two rami of the second cirrus nearly equal; caudal appendages uniarticulate, short and spinose at the extremity.

This genus is nearly related to *Pœcilasma*. However, my reasons for separating it from that genus are, I think, as important as those for separating *Pœcilasma* and *Lepas*, or *Pœcilasma* and *Dichelaspis*. The new genus must be placed in the same Family as these genera, being easily distinguished from them by the form of the scutum and the width of the carina. With regard to the carina, *Pœcilasma carinatum*, which I described on p. 44, shows a considerable resemblance to *Megalasma;* and to this affinity the form of the scutum only partly opposes itself. For in *Pœcilasma carinatum* the basal margin, which in *Megalasma* is totally wanting, has become a great deal shorter than in the other species of the same genus; so it seems that *Pœcilasma* leads to *Megalasma* through *Pœcilasma carinatum*.

The animal's body only slightly differs from that of *Pœcilasma*, the most remarkable difference consisting in the unequal thickness of the rami of the first cirrus.

As only one species of the new genus is known, I think it better not to enlarge upon the description of the genus. Its habits and distribution will also be given under the head of the species.

[1] From μέγας, great, and ἔλασμα, plate or valve.

Megalasma striatum, n. sp. (Pl. II. figs. 5–9; Pl. VII. figs. 8–9).

With the characters of the genus.

General appearance.—The capitulum is large and resembles much in outline the shell of a Lamellibranchiate Mollusk. The short peduncle is quite covered by the capitulum. The shape of the capitulum is very characteristic; it is ovate, with both extremities pointed, the occludent margin being almost exactly of the same length as the carinal margin. All the valves are beautifully and distinctly striated and covered by membrane, which is not very persistent, except over the lines separating the valves.

Scutum triangular, or more exactly still, having the form of a sector of a circle, a little more than 90°. The two radii are represented by the tergo-lateral and carinal margins of the valves. The basal margin seems to be totally wanting; most probably, however, it is represented by the undermost part of the occludent margin. The scutum is divided into two unequal parts by a very prominent ridge which runs from the angle (formed by the tergo-lateral and carinal margins) to the occludent margin, which it meets at one-fifth of the whole length of the occludent margin. The two unequal parts of the scutum separated by this ridge have their lines of growth in a very different direction; those of the larger part run exactly parallel to the tergo-lateral margin, those of the smaller undermost part converge to meet at the angle formed by the carinal and occludent margins. From the point where the ridge meets the occludent margin to its apex, the scutum shows externally a prominent and flattened border, much broader at the apex than at the other extremity, and as far as this border goes, a margin distinctly bent down, which together probably represent the small part, that, in the nearly related genera of Lepadids, is situated between the occludent margin and the ridge which runs from the apex to the umbo. Internally (Pl. VII. fig. 8), this margin projects as a very prominent ridge downwards, terminating in both scuta in a very large tooth. This is situated at a distance of about one-fifth of the length of the occludent margin from the angle formed by the occludent and carinal margins, and has a flat surface of a long oval form; on both two small notches are easily observed. As shown by a dorsal (carinal) view of the animal (Pl. II. fig. 6), the undermost part of the scutum is considerably expanded on both sides. Parallel to the lines of growth the scuta are distinctly striated, the surface of the different stripes being again transversely, but very minutely striated. In my figure (Pl. II. fig. 5) these latter striæ have not been represented. Internally, near the carinal margin, a very small notch is visible for the reception of a tooth of the carina; the tergo-lateral margin shows an indistinct tooth near both extremities; these, of course, serve also for the attachment of the other valves. The smaller undermost part of the scutum has on its surface still another ridge, which describes with its continuation situated on the carina half a circle, as will be easily understood from fig. 5 on Pl. II.

Tergum triangular, the occludent margin is only a little longer than the scutal margin. The occludent margin shows the same flattened border as the larger and uppermost part of the scutum; on the contrary (as seen from Pl. VII. fig. 8), the bent-down margin on the occludent side is not represented. As shown by fig. 6 (Pl. II.) such a bent-down margin is very strongly represented along the carinal margin of these valves, where it forms the continuation of the much flattened dorsal margin of the carina. Basal angles pointed. The surface of the terga shows the same striation as that of the scuta. Its lines of growth run parallel to the scutal margin.

Carina externally almost entirely resembling the tergum (or the continuation of the two terga). It is broad, especially towards its basal end, and much arched, running up just between the basal ends of the terga. As I have already said, the dorsal margin is much flattened, being broadest towards the upper end and gradually diminishing towards the lower end. This dorsal flattened part is slightly but distinctly furrowed in a longitudinal direction, the furrow forming the continuation of the margin between the two terga. The surface is striated as in the other valves. The base is abruptly truncated. At the inferior side the carina is barely concave, the undermost part being separated from the larger uppermost part by an incomplete partition of a semi-annular form. The latter resembles much the internal structure of the carina of *Pœcilasma carinatum* (Pl. VII. figs. 6 and 8).

Peduncle very short, totally covered by the capitulum.

Mouth.—Labrum with a row of teeth beneath the crest, which is bullate, and a pair of slender palps with hairs at the internal surface (Pl. II. fig. 7). *Mandibles* (Pl. II. fig. 8) with four teeth, the first standing a little way apart from the others, the fourth close to the inferior angle, which is very little developed, and terminates in two microscopical points. *Maxillæ* (Pl. VII. fig. 9) with two larger and two smaller spines on the upper angle; notch beneath the upper spines very large, and furnished with two not very long and not very thick spines. Inferior upraised part with a double row of rather long and thin spines. The whole maxilla has a very striking triangular form.

Cirri.—First pair (Pl. II. fig. 9) far removed from the second pair, and about half their length. Anterior ramus thicker than the posterior, the latter a little longer. Both rami have eight segments. Numerous spines along both sides of the different segments, and especially at the exterior face of the longest and thinnest ramus.

Second pair with the anterior ramus a little shorter but not thicker than the posterior, the number of segments of the longest ramus being thirteen, of the shortest eleven. On most segments the number of pairs of spines along the margin is five. Of these the first pair is extremely small, the second a little stronger, the three others of normal length and strength. The anterior ramus, moreover, shows transverse rows of about four spines on the lines separating the segments.

Sixth pair with equal rami and both of thirteen segments. The arrangement of the

spines is as follows: there are five pairs along the anterior margin, the first pair very minute, the second pair smaller than the three other pairs, and tufts of, as a rule, three spines on the posterior margin on the limit of two segments. On the seventh and eighth segments of the anterior ramus a single spine is situated nearly in the middle. Pedicels of the cirri not very long, rami rather long and slender; second segment of the pedicels slightly protuberant, those of the rami not protuberant but elongated.

Caudal appendages.—Short, not quite one-third the length of the pedicels of the sixth cirrus, terminating rather abruptly and broad, with a row of strong and slender spines at the extremity.

Ova unknown.

Size.—The largest specimen collected measures 11 mm., the next largest measures 7 mm.

Number of specimens.—In all six specimens and two extremely small ones, measuring 1 mm. only, were collected.

Habitat.—This species lives attached to the spines of an *Echinus*, and was dredged at Station 204, November 2, 1874; lat. 12° 43′ N., long. 122° 10′ E.; depth 100 and 115 fathoms; bottom, mud. (Philippine Archipelago.)

Conchoderma, Olfers, 1814.

In the collections made during the cruise of the Challenger, the genus *Conchoderma* is represented by the species *Conchoderma virgatum*, Spengler, and by some small specimens which were found attached to a turtle, and which, according to Darwin, is a variety of *Conchoderma virgatum*.

As far as our knowledge goes, only two really different forms, true species therefore, can be distinguished in this genus. They are the *Conchoderma auritum*, Linn., sp., common on whales—when it is often found attached to *Coronulæ*—and the above-named *Conchoderma virgatum*, Spengler. A third species, *Conchoderma hunteri*, Owen, has been described by Darwin from specimens preserved in spirit in the museum of the College of Surgeons. This may be a different species; but I think on account of its strong resemblance to the variety *Conchoderma virgatum*, var. *chelonophilus*, Leach, and the complete conformity of all its interior characters to those of *Conchoderma virgatum*, it would be a great deal more rational to regard it also only as a variety of *Conchoderma virgatum*.

Gerstäcker (Bronn, "Classen und Ordnungen," *loc. cit.*, p. 535) says that the genus contains five species: besides the three species of Darwin he mentions *Conchoderma gracile* of the European seas (p. 577), and *Conchoderma coronularium* (p. 578) from the west coast of South America. Of these the first is a species of Heller, who observed it in the

Adriatic on the gills of *Maja squinado*. However, there can be little doubt but this is indeed a species of *Dichelaspis*, and I even feel convinced that it is the same as *Dichelaspis darwinii*, Filippi.[1] *Conchoderma coronularium* I have not been able to make out; whether it corresponds to *Conchoderma auritum*, Linn, sp., or perhaps represents a different species, I cannot say. Perhaps it is the same as *Otion stimpsoni*, Dall, which species is founded upon a very imperfect description without figures by Mr. Dall.[2] This species has, according to this author, only the scuta, whereas typical specimens (according to Leach, and also according to Darwin) are furnished with five valves (two scuta, two terga, and a carina). Darwin says, however, that in *Conchoderma auritum* the terga and the carina are often absent, and this seems especially to be the case in the large specimens which are found attached to *Coronulæ* on whales. Now, the specimens which Mr. Dall took from *Coronula* (sessile on the "Humpback") had a length of almost 5 inches (peduncle 2·8 inch, body 2·16 inch); I therefore think it very probable that the species of Mr. Dall is the same as *Conchoderma auritum*, which, according to Mr. Darwin, is a world-wide and extremely common species.

The characters of the genus are the following:—Capitulum almost totally membranous; valves two to five, minute, remote from each other; scuta with two or three lobes, with their umbones in the middle of the occludent margin; carina arched, upper and lower ends nearly alike. Filaments[3] numerous, not only two pairs seated beneath the basal articulations of the first pair of cirri, but also on four or five anterior pairs; mandibles with five teeth, finely pectinated; maxillæ with distinct steps; caudal appendages none.

No fossil remains of this genus are known. The smallness of the calcified valves may possibly be the cause of this; it would be rather rash in my opinion to conclude that it is a genus of recent occurrence only, because it has not as yet been found in fossil deposits

Both species are extremely common, and have, as Darwin says, a world wide distribution. They live attached to floating objects, bottoms of ships, sea-weed, turtles, whales, &c. They can be distinguished from each other in the following way:—

[1] Of this species Heller gives the following description:—"Stiel vom Köpfchen deutlich abgesetzt, bis 2½‴ lang, das Köpfchen von fast gleicher Länge, umgekehrt herzförmig, hinten breit, nach vorn und unten verschmälert. Der Mantel ist dünn, halbdurchsichtig, gelblichweiss, nur durch einige kleine Kalkreifen gestützt. Die Carina erscheint ehr dünn, verläuft am obern stark gekrümmten Rande nach hinten, wo sie sich in zwei Schenkel theilt, die beiden schmalen Scuta sind ebenfalls zweischenkelig, die Schenkel unter einem ziemlich spitzen Winkel vereinigt. Auch finden sich nach vorn hin zwei kleine hakig gekrümmte Tergalstücke in der Mantelhaut. Der Körper selbst ist am Vorderende in ein hakig gekrümmtes Rostrum verlängert.

[2] *Proc. Calif. Acad. Nat. Sci.*, vol. iv. 1873, p. 301.

[3] Gerstäcker (*loc. cit.*, p. 535), calls the filaments of *Conchoderma* filamentary gills (geisselartige Kiemen). I do not believe, however, that it is proved that these structures are respiratory.

Conchoderma.

1. Filaments attached to the pedicel of the second cirrus, capitulum with two tubular ear-like appendages, scuta bilobed, ... *Conchoderma auritum*, Linn., sp.
2. No filaments attached to the pedicel of the second cirrus, capitulum without tubular ear-like appendages, scuta three-lobed, ... *Conchoderma virgatum*, Spengler, sp.

Conchoderma virgatum, Spengler, sp.

Lepas virgata, Spengler, Skrifter Naturh. Selskab. I. 1790, Tab. vi. fig. 9.
Conchoderma virgata, Darwin, Lepadidæ, 1851, p. 146.

Of this species Darwin gives the following definition, which I think is quite sufficient to characterise it:—Scuta three-lobed; terga concave internally, with their apices slightly curved inwards; carina moderately developed, slightly curved; peduncle blending into the capitulum. No filament attached to the pedicel of the second cirrus.

I do not wish to add anything to the very detailed description which Darwin gives of this species. To make a comparison of this species with the variety *chelonophilus* possible, I made a preparation of the parts which constitute the mouth. Of the maxillæ Darwin says that they have five steps; sometimes each step commences with a spine rather larger than the others; at the upper angle there are two large unequal spines (neither pectinated), with a third, longer and thinner, situated a little below. That the large spines of the upper angle are not pectinated has been pointed out by Darwin, as it furnishes a remarkable difference from the spine of the maxilla of *Conchoderma auritum*. I am obliged, if not to deny the value of this characteristic, at least to diminish it. When studied with an ordinary pocket lens the same spine appears in *Conchoderma virgatum* to be distinctly pectinated near its base.

Two specimens of this species were taken from the screw of the Challenger at St. Vincent, Cape de Verdes, on the 25th April 1876, on the ship's voyage homeward. According to Darwin, the growth of this species is very rapid.

Conchoderma virgatum, var. *chelonophilus*, Leach (Pl. II. figs. 13–15).

Conchoderma virgata, var. *chelonophilus*, Leach, Darwin, Lepadidæ, 1851, p. 151.

Though the capitulum of this form differs considerably in appearance from that of the common *Conchoderma virgatum*, Darwin regards it only as a variety of that species. This he does because all parts of the animal, and especially the mouth and the cirri, are quite identical in the species *Conchoderma virgatum*, and in the present form. Perhaps, Darwin says, this variety may turn out to be a true species; but as our knowledge since Darwin published this supposition has been almost stationary, I think it safest to follow his example. However, I am willing to confess that, if no intermediate forms exist, in

my opinion the smallness of the form, the totally different shape of the capitulum, and its living exclusively on the carapace of turtles are sufficient characters for regarding it as a true species. I give a figure of this form on Pl. II. fig. 13. It is represented by a considerable number of specimens, which are all very small, none having a capitulum of the size of half an inch, the greatest length observed by Darwin. The parts of the mouth are exactly as in *Conchoderma virgatum*. In one of the specimens I investigated, however, the left hand mandible is malformed in a curious way (having seven teeth without the inferior angle), whereas the right hand mandible looks exactly normal. I have figured both mandibles on Pl. II. figs. 14 and 15. These parts, as is well known, often show anomalies of more or less importance.

These specimens were taken from the carapace of a *Chelone*, between Gibraltar and Madeira, January 31, 1873. Darwin says that it is only found on the *Testudo caretta;* whether this is the only turtle on which it lives I cannot say. With regard to the smallness of this variety, I must add that I got specimens from the Royal Museum of the Netherlands (labelled "on *Chelone*, lat. 35° N., long. 14° W."), which were much larger, and even larger than the size given by Darwin (13 mm.), the length of the capitulum being almost 18 mm.[1]

Fresh evidence of the great variability of this species is furnished by the study of specimens of this species from the Gulf of Naples. It is the form of the valves, and especially of the scutum, which in these specimens shows a very interesting deviation from the typical form, the three lobes of the scutum not being broad but narrow, as in the *Conchoderma hunteri*, Owen, sp., and the carina which is also much more slender. As this very narrowness of the valves is the most distinctive character by which the latter species can be distinguished from *Conchoderma virgatum*, the study of the Mediterranean form has confirmed my opinion that it is by far the safest way at present to accept only two species, and to consider all the other forms as varieties.

Alepas, Sander Rang, 1829.

With the exception of one species, *Alepas parasita*, Sander Rang, which measures two inches, all the species of this genus are rather small. They are found attached to various living objects, fixed or floating. *Alepas parasita* has been always taken on Medusæ, *Alepas minuta*, Philippi, lives attached to a *Cidaris*, *Alepas cornuta* to an *Antipathes*, *Alepas tubulosa*, Quoy et Gaimard, to a living *Palinurus*.

Off New South Wales, the Challenger collected some specimens of a species of this genus, which were attached to the spines of an Echinid (*Phormosoma*).

The little group of Lepadids which constitute this genus is sharply defined by the following characteristics:—The capitulum is either without valves, or with horny almost

[1] The size is no doubt a very bad characteristic. I received specimens from the Gulf of Naples of *Conchoderma virgatum* as well as of *Conchoderma auritum*, both remarkable for their smallness.

hidden scuta. Filaments one pair, seated beneath the basal articulations of the first pair of cirri; the mandibles have two or three teeth, the maxillæ are notched, the caudal appendages are multi-articulate.

This genus forms the transition from those with distinct and well-developed valves to the genus *Anelasma*, which is quite destitute of valves. In those species which are furnished with scuta, these valves resemble in form those of *Conchoderma*, and according to Darwin it shows also some affinity to this genus by the ovarian tubes in *Alepas cornuta* surrounding the capitulum. According to this same author, *Alepas* has perhaps a closer affinity to *Ibla*. But as I do not know this genus from personal investigation, I think it better to refer to the work of Darwin.

This genus has a world-wide range, though represented by a few species only, and never by a great number of specimens. As to its range in depth, almost nothing is known as yet. As a rule, they inhabit either the surface of the sea or rather shallow water. The new species, which will presently be described by me, is the first taken from so considerable a depth as 410 fathoms.

To determine the species of this genus, I have composed the following table :—

Alepas.

1. Scuta horny, covered by the integument of the capitulum.
   - i. Orifice one-third of the length of the capitulum; total length not quite half an inch,[1] . . . *Alepas minuta*, Philippi.
   - ii. Orifice two-thirds of the length of the capitulum; total length two inches, ... *Alepas parasita*, Sander Rang.
2. Scuta wanting; orifice slightly protuberant.
   - i. Inner rami of the fifth and sixth cirri rudimentary, *Alepas cornuta*, Darwin.
   - ii. Inner rami of the fifth and sixth cirri normal, . *Alepas pedunculata*, n. sp.
3. Scuta wanting; orifice tubular, protuberant, . . . *Alepas tubulosa*, Quoy et Gaimard.

Alepas pedunculata, n. sp. (Pl. III. figs. 1–5; Pl. VII. figs. 10, 11).

Orifice slightly protuberant, small. Scuta wanting, capitulum globular, without projections along the carinal margin. Peduncle a little longer than in the other species of the genus. Outer maxillæ with the inner bristles divided into two groups; segments of the posterior cirri not very numerous, inner rami of the fifth and sixth cirri as strongly developed as the outer rami.

Capitulum globular, with the carinated edge smooth, entirely destitute of valves. Colour, flesh-colour, dotted over with small red spots. Orifice slightly projecting or tubular, parallel to the longitudinal axis of the peduncle, with the edges sinuous. As

[1] Darwin (*loc. cit.*, p. 161), says that the total length of the largest specimen he examined was about one-fourth of an inch. I got specimens from the Gulf of Naples, the largest of which was almost 12 mm. In these larger specimens the scutum is almost entirely hidden.

in *Alepas cornuta*, Darwin, the orifice appears more sinuous than it really is, from the convexity of the part of the capitulum immediately beneath the orifice.

Peduncle almost as long as the capitulum, the one insensibly passing into the other; the peduncle, however, is much narrower than the capitulum, and is furnished with a swelling towards its upper end. Colour and red spots as in the capitulum.

Size.—The largest specimen, including the peduncle, was 13·5 mm. in length, and 5 mm. across the capitulum.

Filamentary appendages.—One on each side, not very short, tapering and pointed; seated on the posterior margin of the swelling beneath the basal articulation of the first cirrus (Pl. III. fig. 4).

Mouth.—Labrum (Pl. VII. fig. 10) not very prominent or bullate, crest with a row of blunt bead-like teeth, and externally to these there are no bristles. *Palpi* triangular, by no means so narrow as those of *Alepas cornuta*, thickly closed with doubly serrated bristles along their inner margins. *Mandibles* (Pl. III. fig. 2) with three teeth, the third has a toothed edge as in *Alepas minuta* and in *Conchoderma;* inferior angle rather stout and also furnished with teeth. Both sides covered with bristles, strongly projecting over the hinder margin of the inferior angle. *Maxillæ* (Pl. III. fig. 3).—Upper extremity with one very strong and two rather smaller spines. Beneath these there is a somewhat indistinct notch, in which four or five small spines are seated. Inferior part not very prominent, with numerous doubly arrayed spines, two of which are much stronger than the others. Steps not distinct. *Outer Maxillæ* (Pl. VII. fig. 11) with a semicircular outline; serrated bristles in front indistinctly divided into two groups.

Cirri not very long, slightly curled towards the extremity. Pedicels in proportion long, rami rather short. Segments short, inconsiderably produced towards the extremity. *First cirrus* (Pl. III. fig. 4) close to the second, top of its pedicel on a level with the top of the pedicel of the second cirrus. Rami not very short, more than three-quarters of the length of those of the second cirrus, unequal, the anterior ramus being a little longer than the posterior ramus; the posterior contains seven, the anterior eight not very distinct segments. Their form is nearly quadrangular and not protuberant. The anterior and longer ramus is a little thicker than the other. Spines very numerous on the outer surface, and placed on the margins of the segments only at the inner side. Those of the two last segments are a little shorter and more robust. *Second cirrus* with almost equal rami of fourteen short segments. Pedicel long as in the other cirri. Bristles forming rows at the outer margin of each segment, and forming tufts at the slightly protuberant anterior side of each segment. The *sixth cirrus* (Pl. III. fig. 5) has also fourteen segments in both rami; the rami are equal, and show the same arrangement of the bristles as the second cirrus. The bristles at the hinder side of each segment are longer than those placed at the front side.

Caudal appendages (Pl. III. fig. 5), very long and very slender; they reach as far

as the extremity of the third segment of the hinder ramus of the sixth cirrus, and are ten-jointed, with a long pedicel. A row of very minute bristles is placed round the upper margin of each segment, a somewhat longer tuft is inserted on the slender terminal segment.

Penis distinctly segmented or ringed. Short and very thick, with numerous slender and isolated hairs, and a tuft of longer and stouter ones at the extremity.

This species was found on the spines of a deep-sea Echinid *Phormosoma hoplacantha*, A. Ag.; it was dredged during the cruise of the Challenger at Station 164A, June 13, 1874; lat. 34° 13′ S., long. 151° 38′ E.; depth, 410 fathoms; bottom, grey ooze. Off New South Wales.

Affinities.—It is possible that *Alepas tubulosa*, Quoy et Gaimard, is the same species as the one collected by the Challenger. However, I prefer to consider the latter as a different species, because the former has a distinctly tubular orifice, which is not the case with my *Alepas pedunculata;* and as regards other characteristics, the imperfect description published in the voyage of the "Astrolabe" leaves us quite in the dark. The form of the capitulum with the slightly protuberant orifice no doubt shows a certain resemblance to *Alepas cornuta*, Darwin. But the latter species is easily distinguished from mine—(1) by the flattened projections along the carinal margin of the capitulum; (2) by the rudimentary condition of the inner rami of the fifth and sixth cirri; and (3) by the large number of the segments of the posterior cirri.

Scalpellum, Leach, 1817.

Darwin's diagnosis is as follows:—Valves twelve to fifteen in number; latera of the lower whorl four or six, with their lines of growth generally directed towards each other; sub-rostrum very rarely present; peduncle squamiferous, most rarely naked. Filamentary appendages none; labrum with the upper part highly bullate; trophi various; olfactory orifices more or less prominent; caudal appendages uniarticulate and spinose, or none.

This at least is the diagnosis for the hermaphrodite and female specimens, to which diagnosis Gerstäcker adds that the mandibles have three or four teeth, that the first cirrus is seated far distant from the second, and that the second and third cirri have the rami more thickly clothed with spines than the three posterior cirri.

The males (Darwin) are parasitic at or near the orifice of the sack of the female or of the hermaphrodite; thorax enclosed within a capitulum, furnished with three or four rudimentary valves, or with six perfect valves; peduncle either short and distinct, or confounded with the capitulum; sometimes mouth and stomach absent, and cirri non-prehensile; sometimes mouth and cirri normal.

Darwin (1851) has described six recent species belonging to this species; Gerstäcker

(1869–70) states the number of recent species is seven, one species (*Scalpellum stroemii*) having been described in 1858 by M. Sars. To this number four species were added by Prof. G. O. Sars (1877 and 1880), and one by Prof. Wyville Thomson (*Scalpellum regium*), from specimens collected during the cruise of the Challenger. The total number of recent species hitherto known, therefore, amounts to twelve. Though all the records of zoological literature have been carefully searched, I do not feel sure that this number really represents the total of at present known recent species; especially since it appears from the collections made during the cruise of the Challenger that the number of existing species greatly exceeds the above named number. More than forty species will later on be described as new to science! Yet I need hardly repeat here that it is often an utter impossibility to avoid describing a species as new, the description of which has been published perhaps long ago in the Transactions of some Asiatic or Australian Society, the existence of which has not even come to the knowledge of the recorders of zoological literature.

The majority of the new species are inhabitants of deep-water. *Scalpellum* seems to be the only genus of Cirripedia which is often met with in the great depths of the ocean. This strikingly coincides with the common occurrence of this genus in the fossil deposits, especially in secondary strata (Cretaceous period). However, the genus *Pollicipes* is there to show that we must not attach too much value to this coincidence (see p. 26). *Pollicipes* is the oldest known fossil genus, all its species live exactly under the same circumstances as the species of *Scalpellum*, viz., attached to various objects which are found on the bottom, but not a single species has been hitherto taken from any considerable depth!

The same observation which Darwin made with regard to the number of specimens of Cirripeds during the Cretaceous period may be made for the living species of this genus; although, Darwin says, the number of species was considerable, the individuals were mostly rare. Now the number of species of the genus *Scalpellum* represented in the Challenger collections amounts to forty-three, and of these twenty-six are represented by a single specimen only, four are represented by two, five by three, two by four, and six only by more than four specimens.

The great number of species in this genus suggested the idea of dividing it into smaller genera. After careful examination this idea, however, has been given up, as all the species in essential characters correspond as closely, even more closely, with one another than in any other genus of Cirripedia. Nor has it been an easy matter to arrange the species in a natural way, especially because I was not at liberty to make preparations of the parts of the mouth and of the cirri of those species which are represented by single or by two specimens only. For this reason, as well as for the sake of practical utility, I have made use of externally visible characters only, such as are furnished by the condition, number, and shape of the different valves of the capitulum, in order to differentiate the various species in the table which follows.

In the first place, I separate those species which have imperfectly calcified valves from those with perfectly calcified ones. Whereas the first division of the genus only contains at present five species, the latter numbers forty-seven. These may be subdivided by the aid of the form of the carina, viz.: into species with a carina a portion of which projects freely, into species with an angularly bent carina, and into species with a simply bowed carina. The species with a carina having a portion projecting freely much resemble species of the genus *Pollicipes*, Leach, and perhaps must be considered as forming

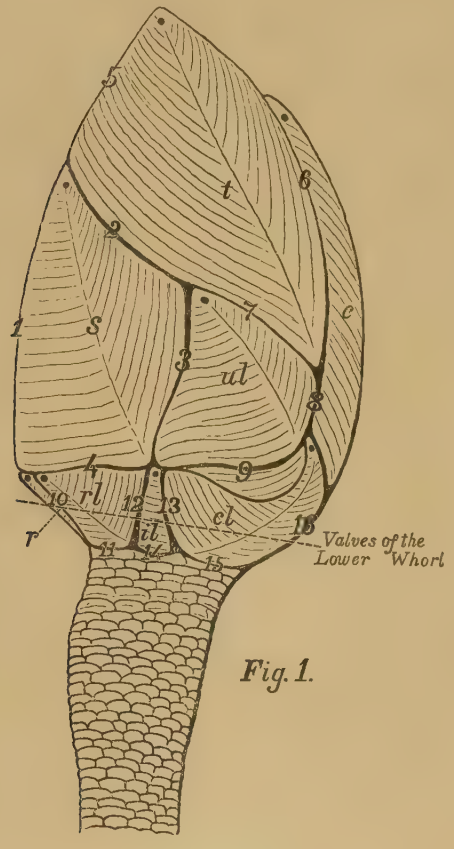


Fig. 1.

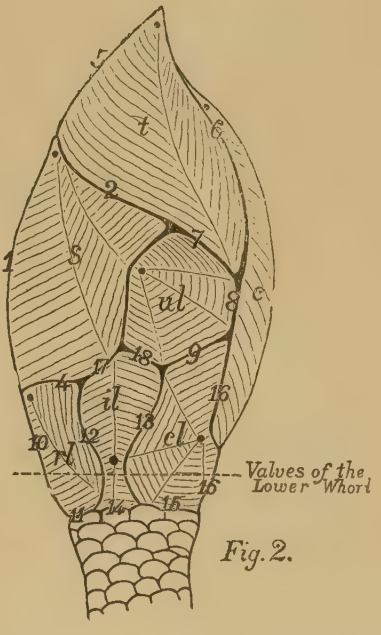


Fig. 2.

In both figures a point indicates the place in each valve where the umbo is situated. *s*, scutum; *t*, tergum; *c*, carina; *ul*, upper latus; *rl*, rostral latus; *il*, infra median latus; *cl*, carinal latus; 1, occludent margin of the scutum; 2, tergal do.; 3, lateral do.; 4, basal do.; 5, occludent margin of the tergum; 6, carinal do.; 2, scutal do.; 6, 8, tergal margin of the carina; 3, scutal margin of the upper latus; 7, tergal do.; 8, carinal do.; 9, basal do.; 10, rostral margin of the rostral latus; 11, basal do.; 12, lateral do.; 4, scutal do.; 12, rostral margin of the infra-median latus; 13, carinal do.; 14, basal do.; 13, lateral margin of the carinal latus; 15, basal do.; 16, carinal do.; 9, upper do.; In fig. 1—*r*, rostrum. In fig. 2—17, scutal margin of the infra-median latus; 18, upper do.

a link between the two genera. Only two species belong to this division. Eight species have an angularly bent carina, so that by far the greatest number (thirty-seven) belong to that division which contains the species with a bowed carina. Only in one of the living species is a sub-carina present. Of the remaining thirty-six, twenty-one have a rostrum and fifteen have no rostrum. Four of those with a rostrum have the rostrum

not covered laterally by the free edges of the rostral latera, seventeen have the rostrum laterally covered.

For the right understanding of the nomenclature used for the valves and their margins in the genus *Scalpellum* the woodcuts figs. 1 and 2 will prove useful.

Fig. 1 represents a *Scalpellum with* a rostrum, and therefore with fourteen valves. Fig. 2 one *without* a rostrum, having therefore only thirteen valves. (A species with a subcarina is figured on Pl. III. fig. 19.) In most valves the umbo is situated at the same place in both figures. The exceptions to this rule are the upper-latus, infra-median latus, and carinal latus. The upper latus, as a rule, has the umbo at the apex, as in fig. 1. In *Scalpellum distinctum*, n. sp. and *Scalpellum planum*, n. sp. however, it is nearly in the middle of the scutal margin. The infra-median latus, ordinarily, is triangular, and in that case it has the umbo at the apex. Sometimes, however, its shape is that of an hour-glass or of an elongate wine-glass on its stand, and then the umbo is seated near or under the middle of the valve. Very interesting are the differences which the carinal latus shows in the different species. There are two types which are represented in the two figures 1 and 2. In fig. 1 the valves of the lower whorl (the rostrum—when there is one—the rostral latus, the infra-median latus, and the carinal latus) are not very much developed in the direction of the long axis of the capitulum. On the contrary, the same valves are much higher or more elongate in the other type (fig. 2). This influences the shape of these valves, but specially that of the carinal latus. In the one (fig. 1 : type, *Scalpellum maximum*, Darwin) the umbo is placed at the apex, as closely as possible to the upper latus. In this case the whole of the carinal margin of this valve extends beneath the umbo. In the other case (fig. 2 : type, *Scalpellum vulgare*, Leach) the umbo is placed at a somewhat considerable distance from the apex, and then either at the base of the carinal margin or about the middle of that margin.

These two forms of the carinal latus were known to Darwin. It is curious enough that all the recent forms known to Darwin have the carinal latus of the shape of fig. 2, and all the fossil forms in which he was able to describe this valve—with the exception of one—show the type of fig. 1. However, this latter type is also represented in the living forms; a considerable number of the species inhabiting the deep-sea and dredged by the Challenger give proof of it. There are in all thirteen species corresponding with the fossil *Scalpellum maximum* with regard to the form of the carinal latus, and nine of these inhabit a depth greater than 500 fathoms. On the other hand, we must not lose sight of the fact that of the remaining twenty-nine species only three were taken at a depth less than 500 fathoms; that the other type, therefore, is represented by twenty-six species in the deep-sea! In the case of the present genus we find, therefore, that the abyssal fauna consists partly of species resembling fossil forms, and for a much more considerable part of species of a true shallow-water type.

Nor does the study of the form of the carina give a more decided result. Darwin

was only acquainted with one recent species of *Scalpellum* (*Scalpellum rutilum*, Darwin), with a simply bowed carina, the umbo of which was placed at the apex. The greater part of his living species had the carina angularly bent. Of the fossil species, on the contrary, he mentions only one (*Scalpellum magnum* (Wood), Darwin), with an angularly bent carina; all the others have the valve simply bowed. Now, as a rule, the carina of the deep-sea species is simply bowed, as is the case with the fossil species. But it is not a rule without an exception, as *Scalpellum stroemii*, Sars, and *Scalpellum carinatum*, n. sp., have the carina rather more angularly bent.

As one of the more interesting forms of Cirripedia dredged during the cruise of the Challenger, I may mention here *Scalpellum trispinosum*, n. sp., which is nearly related to *Scalpellum villosum*, Leach, sp. Like the latter it is highly characteristic, being an intermediate form between *Scalpellum* and *Pollicipes*. It was collected in the Malay Archipelago, at a depth of about 100 fathoms.

The study of the complemental males of some of the species of *Scalpellum* has given very interesting results. Since a more detailed treatment of the organisation of these little creatures will not be given in the present report a preliminary description is inserted under the heading of the different species.

The following table may be of use for the determination of the species :—

Scalpellum.

A. Valves imperfectly calcified.
  A. Valves of the lower whorl imperfectly calcified as well as the other valves, *Scalpellum marginatum*, n. sp.
  B. Valves of the lower whorl perfectly calcified.
    a. Calcified portion of the upper latus elongate.
      (a) Apex of the tergum curved towards the carina, . . *Scalpellum japonicum*, n. sp.
      (b) Apex of the tergum straight, ... *Scalpellum insigne*, n. sp.
    b. Calcified portion of the upper latus not elongate.
      (a) Calcified portion distinctly V-shaped, . . . *Scalpellum ovatum*, n. sp.
      (b) Calcified portion only slightly concave, . . . *Scalpellum intermedium*, n. sp.
B. Valves perfectly calcified.
  A. Species with a carina a portion of which projects freely.
    a. With a sub-rostrum and sub-carina, ... *Scalpellum villosum*, Leach, sp.
    b. With a sub-carina only, ... *Scalpellum trispinosum*, n. sp.
  B. Species with the carina angularly bent.
    a. With a distinct rostrum.
      (a) With a sub-carina.
        α. Three pairs of lower latera, ... *Scalpellum rostratum*, Darwin.
        β. Two pairs of lower latera, ... *Scalpellum peronii*, Gray, sp.
      (b) Without a sub-carina.
        α. Umbo of the carina at a considerable distance from the apex.

i. Upper latus quadrant-shaped, with the arched side deeply notched, ... *Scalpellum ornatum*, Gray, sp.
ii. Upper latus irregularly oval, ... *Scalpellum vulgare*, Leach.
β. Umbo of the carina at a small distance from the apex.
i. Infra-median latus large, oblong-quadrangular, . *Scalpellum stroemii*, Sars.
ii. Infra-median latus large, wine-glass-shaped, . *Scalpellum carinatum*, n. sp.
iii. Infra-median latus small, triangular, . . *Scalpellum recurvirostrum*, n. sp.

B. Rostrum wanting or not distinct, ... *Scalpellum compressum*, n. sp.

C. Species with the carina simply bowed.
A. With a sub-carina, ... *Scalpellum acutum*, n. sp.
B. Without a sub-carina.
(A) Rostrum present.
a. Rostrum not covered laterally by the free edges of the rostral latera.
i. Rostrum wedge-shaped. Carina short, . . *Scalpellum brevecarinatum*, n. sp.
ii. Rostrum elongate, narrow. Carina long, . . *Scalpellum angustum*, G. O. Sars.
iii. Rostrum wine-glass-shaped. Carina long, . *Scalpellum parallelogramma*, n. sp.
iv. Rostrum protuberant, hook-shaped. Carina long, *Scalpellum hamatum*, G. O. Sars.

β. Rostrum covered laterally by the free edges of the rostral latera.
i. Rostrum large oval.
(i) Valves separated by distinct chitinous intervals, ... *Scalpellum album*, n. sp.
(ii) Valves not separated by chitinous intervals, . *Scalpellum africanum*, n. sp.
ii. Rostrum small, distinctly visible at the surface.
(i) Surface of the valves with long hairs, . *Scalpellum hirsutum*, n. sp.
(ii) Surface of the valves smooth, or with short hairs.
1. Infra-median latus quadrangular, . *Scalpellum nymphocola*, n. sp.
2. Infra-median latus triangular, . . *Scalpellum rubrum*, n. sp.
3. Infra-median latus elongate, narrow, . *Scalpellum cornutum*, G. O. Sars.
4. Infra-median latus very small, . . *Scalpellum striolatum*, G. O. Sars.
iii. Rostrum extremely narrow, hardly visible at the surface.
(i) Tergum bluntly truncated, . . . *Scalpellum truncatum*, n. sp.
(ii) Tergum triangular, not truncated, . . *Scalpellum elongatum*, n. sp.
iv. Rostrum only visible after the chitinous membrane has been taken away.
(i) Umbo of the carinal latus almost at the base of the valve, ... *Scalpellum antarcticum*, n. sp
(ii) Umbo of the carinal latus at a distance from the base.
1. Roof of the carina flat.

(1) Umbo of the carinal latus much projecting beyond the line of the carina.
a. Upper latus triangular, . . *Scalpellum velutinum*, n. sp.
b. Upper latus quadrangular, . *Scalpellum pedunculatum*, n. sp.
(2) Umbo of the carinal latus not much projecting, . . . *Scalpellum eximium*, n. sp.
2. Roof of the carina slightly convex laterally.
(1) Carinal latus very high, . . *Scalpellum gigas*, n. sp.
(2) Carinal latus not very high.
a. Upper latus almost triangular, . *Scalpellum moluccanum*, n. sp.
b. Upper latus rather quadrangular.
(*a*) Peduncle short, . . *Scalpellum regium* (Wyv. Thoms.), n. sp.
(*b*) Peduncle long, . . *Scalpellum darwinii*, n. sp.

(B) Rostrum wanting.
α. Carina consisting of a roof and distinct sides.
i. Roof flat, bordered by more or less prominent ridges.
(*α*) Infra-median latus large, wine-glass-shaped, . *Scalpellum distinctum*, n. sp.
(*β*) Infra-median latus middle-sized, oblong-quadrangular.
(i) Carina almost straight, . . . *Scalpellum minutum*, n. sp.
(ii) Carina strongly bowed, . . . *Scalpellum abyssicola*, n. sp.
(*γ*) Infra-median latus small, triangular, . . *Scalpellum vitreum*, n. sp.
(*δ*) Infra-median latus narrow, elongate.
(i) Scutum almost triangular, . . *Scalpellum planum*, n. sp.
(ii) Scutum quadrangular.
1. Umbo of the carinal latus projecting beyond the carina, . . *Scalpellum australicum*, n. sp.
2. Umbo of the carinal latus not projecting beyond the carina, . *Scalpellum tenue*, n. sp.
(*ε*) Infra-median latus large, quadrilateral, . . *Scalpellum rutilum*, Darwin.
ii. Roof flat, not bordered by distinct ridges.
(*α*) Carina very strongly bowed, . . . *Scalpellum indicum*, n. sp.
(*β*) Carina not very strongly bowed.
(i) Infra-median latus small, triangular, . *Scalpellum iritonis*, n. sp.
(ii) Infra-median latus elongate, quadrangular, *Scalpellum novæ-zelandiæ*, n. sp.
iii. Roof slightly convex laterally.
(*α*) Infra-median latus triangular, . . . *Scalpellum dubium*, n. sp.
(*β*) Infra-median latus narrow, . . . *Scalpellum flavum*, n. sp.
(*β*) No distinct roof can be distinguished on the carina.
i. Carinal latus as high as the carina, . . *Scalpellum balanoides*, n. sp.
ii. Carinal latus of the ordinary height, . . *Scalpellum triangulare*, n. sp.

A. SPECIES WITH IMPERFECTLY CALCIFIED VALVES.

Scalpellum marginatum, n. sp. (Pl. VI. figs. 5, 6).

Valves thirteen, imperfectly calcified, covered by a chitinous membrane. Carina simply bowed, with the umbo almost at the apex. Upper latus has the form of a V, the umbo being placed at the angle of the two segments.

This species belongs to the same division of the genus as *Scalpellum japonicum* and *Scalpellum insigne*, the most characteristic feature of which consists in the valves being imperfectly calcified. The present species is represented by a single specimen only.

The *capitulum* has a nearly oval shape, and is rather flat. It consists of thirteen valves, each of which is imperfectly calcified, and most of which consist of two segments united at the place where the umbo is seated. The valves are clothed by membrane which is covered with extremely minute and short spines.

The *scutum* consists of an occludent and a tergal segment. The latter is narrow, the former is of considerable breadth near the base, growing much narrower towards the upper extremity. The basal margin forms an acute angle with the occludent margin, and is hollowed out for the reception of the scutal margin of the rostral latus. The apex is slightly recurved, the tergal margin slightly hollowed out.

The *tergum* is triangular, and consists, its calcified part at least, of two segments of about the same width and united at the apex, which is distinctly recurved. Occludent margin arched. Carinal segment very long, reaching farther down than half the length of the carina.

Carina simply bowed, the flat roof is bordered on each side by a ridge. The umbo is at a very short distance from the apex of the carina; the part in front of it is a continuation of the sides of the valve. These are not very broad, and have the same breadth over almost the whole length of the carina. Between the carinal margin of the tergum and the side of the carina there is a rather broad oval interspace filled out with chitinous membrane.

Upper latus consisting of two segments which meet one another in the apex. This penetrates into the cavity which was left between the two segments of the scutum. From the umbo, which is seated at the apex, a third calcified segment starts, which, however, is only small, and has a direction perpendicular to the carinal segment of the tergum.

Rostral latus of irregular shape; a narrow segment runs along the basal margin of the scutum and penetrates into the hollow of this margin. A short and stout segment runs close to the upper margin of the peduncle.

Infra-median latus with the umbo near the base. A small triangular part beneath the umbo and a larger triangular part above it. The latter is hollowed out at the upper margin for the reception of the scutal segment of the upper latus. This triangular part is furnished on both sides with a rather prominent ridge.

Carinal latus has also the shape of a V. The umbo is at the base, and at the foot of the carina; it is slightly protuberant beyond the carina, and is acutely pointed. The carinal segment of the valve is rather long, the basal segment a little shorter.

Length of the capitulum, 22·5 mm.

The *peduncle* is short, cylindrical (5 mm.). There are seven rows of scales, each con-

taining about six scales. The scales are covered by membrane, their free edges are broad and rather prominent.

This species was taken north of New Guinea, at Station 216, February 16, 1875; lat. 2° 56′ N., long. 134° 11′ E.; depth, 2000 fathoms; bottom temperature, 0°·9 C.; bottom, Globigerina ooze.

Observations.—As only a single specimen of this species was taken, I was unable to study the structure of the animal more in detail. I tried in vain to find a complemental male at the place ordinarily occupied by them in the species of this genus.

Scalpellum japonicum, n. sp. (Pl. III. figs. 9, 10).

Valves fourteen, calcified only in part, those of the lower whorl perfectly calcified, all covered by a chitinous and villous membrane. Carina with a flat roof, latera of the carina distinctly developed in the uppermost part; umbo of the carina at $\frac{1}{12}$th of the length of the flat roof from the apex. Upper latus of an irregular long oval shape. Peduncle short.

Only one specimen of this species has been collected. In many respects it agrees with *Scalpellum carinatum*, but it may be distinguished at first sight from that species by the valves being incompletely calcified.

Capitulum rather elongated, compressed, the basal part being only slightly thicker. The calcareous parts of the different valves are separated from each other by rather broad chitinous interspaces. Valves incompletely calcified. As far as the valves are concerned, this species stands about in the same relation to the other species of *Scalpellum* as the species of *Dichelaspis* to those of *Lepas*. However, I do not believe that in the present case there can be any question of proposing a generic separation.

Scutum long and narrow, with the umbo at the apex; divided into two segments; the occludent one being large and increasing in width from the upper to the lower part, the other (the tergal one) being very narrow. Occludent margin slightly arched.

Tergum divided into an occludent and a carinal segment, between which there is a triangular chitinous portion. Umbo at the apex, which is distinctly recurved. Occludent margin arched.

Carina with a flat roof much increasing in width from the apex towards the base. The roof is bordered by slightly prominent ridges. Sides of the carina at right angles with the roof, very narrow at the base, broader near the apex, where the two sides meet in front of the umbo. The umbo is situated at about one twelfth of the length of the flat roof from the upper extremity of the valve.

Upper latus of an irregularly oval shape, with the umbo at a short distance from the upper extremity. All round, the upper latus is separated by chitinous interspaces from the other valves. Calcified portion of an elongate shape.

Rostrum extremely small and narrow, hardly visible even with a lens; covered by chitinous membrane.

Rostral latus short, rather broad, convex. Scutal margin straight.

Infra-median latus hour-glass-shaped, with the umbo at the constricted part. The part above the umbo is triangular and large, that beneath it is also indistinctly triangular but very small.

Carinal latus has much the same shape as in *Scalpellum vulgare;* flat, with the umbo at the base of the carina, where the two carinal latera of the right and left side almost touch each other. The carinal margin is divided into two parts, a superior one which is hollowed out, and a very short and slightly protuberant inferior one. The basal margin is short, the lateral margin arched.

Length of the capitulum, 13·5 mm.

The *peduncle* is short (4·5 mm.), curved, with the scales large and not numerous. There are about eight longitudinal rows, each of which contain about seven scales.

The only specimen of this species was found attached to the shell of an Opisthobranchiate Gasteropod (*Rissoa*, sp. ?), and was collected at Station 235, June 4, 1875; lat. 34° 7′ N., long. 138° 0′ E.; depth, 565 fathoms; bottom temperature, 3°·3 C.; bottom, mud.

Observations.—I failed to observe the complemental male of this species. I have not been able to study the parts of its mouth and its cirri, as I was not at liberty to dissect the only specimen which was collected.

Scalpellum insigne, n. sp. (Pl. VI. figs. 3, 4).

Valves thirteen, imperfectly calcified, except those of the lower whorl which are perfectly calcified, covered by membrane which is clothed with spines. Carina with a flat roof and the umbo seated at or close to the apex. Calcified portion of the upper latus semi-lunar in shape. Peduncle short.

This species is represented by a single specimen only; in many respects it comes near to *Scalpellum japonicum.*

Capitulum consisting of thirteen valves, clothed by a thin chitinous membrane covered with numerous very small hairs. The form of the capitulum is elongate-oval. Extremely characteristic is the imperfect calcification of the valves, and especially of the tergum, scutum, and upper latus. These are separated from each other and from the carina by broad chitinous interspaces.

Scutum elongate, almost triangular. Its greatest breadth is near the inferior extremity; its length is only twice this breadth. The umbo is at the apex, which projects over the tergum. The occludent margin is slightly arched. Of the two triangular parts into which the scutum in other species of the genus is divided by a ridge, only one (the occludent one) is calcified, the other is only represented by membrane.

Tergum triangular, with the margins almost straight. The calcified part has the form of a fork, and consists of two segments,—an occludent and a carinal segment of nearly equal width, the point of junction being the apex of the valve.

Carina simply bowed, with a flat roof and well-developed sides, tapering towards the lower extremity. The roof does not increase much in width from the upper to the lower end.

Upper latus of a quadrangular form; the calcified part is semi-lunar, with the umbo at a short distance from the apex; the valve, therefore, is also a little added to upwards.

Rostral latus quadrangular, middle-sized; lateral margin arched.

Infra-median latus triangular, small; umbo at the apex. Rostral and carinal margins hollowed out.

Carinal latus almost triangular, with the umbo near the base, slightly projecting outwards beyond the carina. Carinal margin hollowed out, lateral margin short and rounded.

Length of the capitulum, 16 mm.

Peduncle cylindrical, slightly bowed. Length of the peduncle, about 5 mm. Covered by membrane; the free edges of the scales are only indistinctly visible. There are seven or eight longitudinal rows of scales, each row containing ten or more scales.

This species was taken in the Atlantic at Station VI., January 30, 1873; lat. 36° 23′ N., long. 11° 18′ W.; depth, 1525 fathoms; bottom temperature, 1°·6 C.; bottom, Globigerina ooze.

Observations.—The complemental male of this species is not known, nor could I investigate the structure of the parts of its mouth, cirri, &c.

Scalpellum ovatum, n. sp. (Pl. VI. figs. 7, 8).

Valves thirteen, covered by chitinous membrane, without distinct spines. Tergum and upper latus imperfectly calcified, the calcified portion of the latter being V-shaped. Umbo of the carina close to the apex. Carina with a flat roof, not much increasing in width from the upper to the lower extremity.

Of this species a single specimen was taken at Station 216, at which *Scalpellum marginatum*, n. sp., was also taken. I was a long time in doubt whether it represents a different species, or must be considered as a variety of *Scalpellum marginatum*. I even felt inclined to consider it as an intermediate form between *Scalpellum marginatum* and *Scalpellum compressum*. After much hesitation, however, I decided on describing it as a distinct species.

The *capitulum* is rather flat, though not so much so as in *Scalpellum compressum*, and elongate, being about twice as long as broad. The greatest breadth is a little beneath the umbo of the scutum. The capitulum consists of thirteen valves, the borders of which are not everywhere distinguishable, the chitinous membrane covering the valves being rather thick.

The *scutum* is not very large, of an irregular quadrangular shape. The apex, where the umbo is situated, is produced, the tergal margin hollowed out, the occludent margin convex, the basal margin oblique, with an excavation for the reception of the rostral latus.

The *tergum* is large, surpassing the scutum considerably in area. Its occludent

margin is arched, its apex recurved. The scutal margin is convex and the carinal margin quite indistinct, the valve not being separated by a distinct margin from the side of the carina. The calcified part is V-shaped, and consists of two segments, one at the occludent, and one at the carinal margin of the valve. The latter is a great deal longer and a little broader than the former.

The *carina* has a narrow flat roof, not increasing much in width towards the base, where the roof is slightly furrowed longitudinally. The sides are at angles greater than 90° with the roof. They are not flat but slightly convex, and wider near the upper extremity. They are only indistinctly limited near the tergum and near the upper latus.

The *upper latus* is quadrangular, with the basal-carinal angle truncated; hence the valve is pentagonal. The valve is imperfectly calcified, and consists of two segments uniting at the scutal-tergal angle. The apex is slightly produced over the scutum.

The *rostral latus* is pentagonal, the umbo is seated at the rostral extremity beneath the occludent margin of the scutum. The valve is medium-sized.

The *infra-median latus* is elongate quadrangular; its umbo is situated near the base.

The *carinal latus* is of an irregular shape. A triangular part of it penetrates between the carina and the upper latus. The umbo is near the base, and projects slightly over the base of the carina. The basal margin is straight, the carinal margin hollowed out.

Length of the capitulum, 20 mm.

The peduncle is cylindrical, and almost imperceptibly slopes into the capitulum. The scales are large, and not calcified, or, perhaps, are totally covered by membrane. The edges are not very prominent and their number is insignificant.

This species was taken with *Scalpellum marginatum* at Station 216, February 16, 1875; lat. 2° 56′ N., long. 134° 11′ E.; depth, 2000 fathoms; bottom temperature, 0°·9 C.; bottom, Globigerina ooze.

Observations.—I could not find a complemental male at the place ordinarily inhabited by it. As I had only a single specimen at my disposal, the study of the parts of its mouth and of its cirri has not been undertaken. Still, this would be the only way to ascertain whether or not there exists a specific difference between this species and *Scalpellum marginatum*.

Scalpellum intermedium, n. sp. (Pl. VI. fig. 13; Pl. VIII. figs. 6–8).

Valves thirteen, imperfectly calcified, except those of the lower whorl, all covered by chitinous membrane. Carina with the umbo at the apex and a flat roof bordered on each side by a distinct ridge. Calcified portion of the upper latus only slightly hollowed out and nearly triangular. Peduncle short.

This species was dredged on two occasions. Once two specimens were taken, the other time only one. The tergum is distinctly V-shaped; the upper latus, on the contrary, is only slightly hollowed out at the basal margin.

The *capitulum* is flat and elongate; it is covered by a very thin chitinous membrane, which is only slightly hairy. The number of the valves is thirteen; on close examination, however, a rudimentary rostrum, close to the lower extremity of the occludent margin of the scutum, makes its appearance.

Scutum elongate, twice and a half as long as broad. The occludent margin is distinctly arched, the basal margin almost straight; the lateral margin describes an elegant curve, being arched in the lower half and hollowed out in the upper half. The tergal margin is also slightly hollowed out. The umbo of the valve is at the apex, which is slightly recurved, and projects a little over the tergum.

Tergum triangular; the calcified part consists of an occludent and of a carinal portion. The scutal margin is distinctly hollowed out by a triangular chitinous portion. The sides are nearly straight.

Carina robust, simply bowed, with the umbo at the apex; consisting of a flat roof bordered on each side by a distinct ridge and well developed lateral parts. The latter increase in width from the lower to the upper extremity.

Upper latus nearly triangular or trapeziform, owing to the presence of a very short carinal margin. The umbo is at a short distance from the apex, hence the growth is slightly upwards also. Basal margin slightly excavated about the middle.

(*Rostrum* rudimentary, represented by an extremely small triangular portion.)

Rostral latus convex, quadrangular-trapeziform, the scutal margin being a great deal longer than the basal margin.

Infra-median latus small, triangular. The umbo is seated at the apex.

Carinal latus nearly quadrangular, with the lateral margin parallel to the carinal margin; the latter, however, is a great deal longer, and forms with the upper margin a triangular portion penetrating between the carina and the upper latus. The umbo of the valve is seated at or near the base, and is distinctly protuberant beyond the base of the carina. The basal margin is nearly straight.

Length of the capitulum of the largest specimen, 9 mm.

The *peduncle* is short, measuring in the 9 mm. specimen not quite 2 mm. It is covered by well-developed scales, eight of which are placed in a longitudinal row, seven longitudinal rows composing the armature of the peduncle.

During the cruise of the Challenger, this species was taken at Station 164A, June 13, 1874; lat. 34° 13′ S., long. 151° 38′ E.; depth, 410 fathoms; bottom temperature, ?; bottom, grey ooze. One specimen. Station 169, July 10, 1874; lat. 37° 34′ S., long. 179° 22′ E.; depth, 700 fathoms; bottom temperature, 4°·2 C.; bottom, grey ooze. Two specimens.

Observations.—On investigating the internal surface of the scuta of one of the specimens, I found that both valves were furnished with a complemental male. Like the animal within the capitulum, they were not well preserved, and therefore I will not enter into

details as to their internal structure. The male (Pl. VIII. fig. 8) has an elongate oval shape, the surface is irregularly folded; its length was about 0·75 mm.; it was covered by a thin chitinous mantle bearing very short hairs over its whole surface. At one extremity, which no doubt corresponds to the extremity of the peduncle, a couple of small knobs were seen, which probably served for the attachment to the interior surface of the scutum. At the other extremity rudiments of valves were visible. I could make out four of them, and they had a very regular oval shape. Between these rudimentary valves there is probably an opening present; a tuft of hair-like cirri protrudes from this opening, and may be traced for some distance within the cavity of the mantle.

Of the female and hermaphrodite animal I have figured the mandible and the maxilla. The mandible (Pl. VIII. fig. 6) has three teeth, the first of which is slightly longer than the two others; the inferior angle is a little produced and elegantly pectinated. The maxilla (fig. 7) has the free edge almost straight; two large spines are implanted near the upper extremity, and another large spine is visible at a little distance from the lower end. The remaining spines are small, and placed at some distance from one another.

B. SPECIES WITH PERFECTLY CALCIFIED VALVES.

A. Species with a carina, a portion of which projects freely.

Scalpellum trispinosum, n. sp. (Pl. VI. figs. 15, 16).

Valves thirteen; surface of the valves covered by membrane. Carina simply bowed; umbo at the apex, the part of the carina where the apex is placed projects freely. Rostrum and sub-carina present, sub-rostrum wanting. Upper latus triangular, small; latera of the lower whorl two, small, triangular.

This curious species is represented by a single adult specimen only. Two extremely small specimens of the same species are inserted near its base.

The *capitulum* in general shape resembles that of *Scalpellum villosum*, Darwin. It consists of thirteen valves—the sub-rostrum of *Scalpellum villosum* is not represented in *Scalpellum trispinosum*. All the valves are covered by a villous membrane; the umbones near the apex are the only naked parts. The scuta, terga, and the carina are relatively large; the upper latera and the valves of the lower whorl are small, and placed a little apart from each other. As in *Scalpellum villosum*, all the valves are added to at their inferior ends.

The *scutum* is large, triangular. The apex projects distinctly outwards; the occludent margin is slightly hollowed out; the basal margin is elongated.

The *tergum* is large, flat, triangular, in area much surpassing the scutum. The occludent margin is straight, the scutal margin convex, the carinal margin convex also.

The *carina* is boat-shaped and without a flat roof. The umbo is at the apex, which

projects freely for some distance. The sides of the carina are distinctly developed in the superior part, tapering towards the inferior extremity.

The *rostrum* is short, triangular, with the apex recurved towards the opening slit between the two scuta.

The *upper latus* is triangular, and situated almost between the rostral and carinal latera. Of these valves, and also of the rostrum and the sub-carina, the umbonal parts only can be clearly distinguished, the basal parts being totally embedded in the membrane.

The *carinal latus* is a little smaller than the upper latus; the *rostral latus* is a little smaller than the carinal latus.

Finally, the *sub-carina* almost equals in area the rostrum. Its apex, however, is not so distinctly recurved as is the case in the rostrum.

Length of the capitulum 13 mm., breadth in the middle 8 mm.

The *peduncle* is very robust, its width almost equalling that of the capitulum. It has a length of 6 mm. and is cylindrical, being only slightly compressed laterally. Its extremely small scales are totally covered by membrane, so that not even their summits are visible. The hairs clothing the membrane are very short, and can only be distinguished by means of a magnifying lens.

This interesting species was taken at Station 201, October 26, 1874; lat. 7° 3′ N., long. 121° 48′ E.; depth, 82 and 102 fathoms; bottom, stones and gravel.

Observations.—Station 201 is situated in the Philippine Archipelago, and probably *Scalpellum villosum*, Leach, sp., with which this species is nearly related, is also an inhabitant of the Malay Archipelago. Both species come very near to *Pollicipes*. The small number of the valves and the presence of complemental males made Darwin place *Scalpellum villosum* by the side of the other species of *Scalpellum*. Whereas in the first mentioned point *Scalpellum trispinosum* even surpasses *Scalpellum villosum* (a sub-rostrum which is present in *Scalpellum villosum* is wanting in *Scalpellum trispinosum*), I was unable to ascertain the presence of a complemental male.

B. Species with the carina angularly bent.

Scalpellum stroemii, Sars (Pl. III. fig. 6; Pl. VII. figs. 12–14; Pl. VIII. figs. 1-5).

Scalpellum stroemii, Sars, Forhandl. Vidensk. Selsk. Christiania (1858), 1859, p. 158.
„ „ Sars, Verrill, Amer. Journ. Sci. and Arts, ser. 3, vol. vii., 1874, pl. viii. fig. 7.

Valves fourteen, not covered by membrane. Carina distinctly bent, with the umbo at a small distance from the apex; upper latus pentagonal; valves of the lower whorl much developed. Infra-median latus oblong-quadrangular.

In the collections made during the cruise of the Challenger this species is represented by nineteen specimens. Moreover, Mr. Murray sent me two specimens dredged in the summer of 1882 by H.M.S. "Triton." The description of this species given

by Prof. M. Sars, though not very complete, is sufficient for its recognition. In general appearance it much resembles *Scalpellum vulgare*, but it may be distinguished at first sight by the smoothness of its valves.

The *capitulum* is robust, quadrangular; at the base it is a great deal thicker than near the upper extremity, in the middle of the lower whorl its thickness is increased still more by a gibbous lateral excrescence.

The *scutum* is rather small, slightly longer than broad; its apex distinctly projects over the tergum.

The *tergum* is large, triangular, with the occludent margin convex and the apex recurved. The carinal margin is almost straight, the scutal margin also.

The *carina* is boat-shaped, with the umbo at one-fifth of the length of the valve from the apex. The sides are well-developed, the roof in the lower part is almost flat.

The *upper latus* is of a pentagonal shape, the tergal and scutal margins being nearly equal, as also the three other margins.

The *rostrum* is well-developed, cuneiform, narrow at the apex, which projects over the edge of the scutum, and considerably increasing in width towards the base.

The *rostral latus* is trapeziform, the basal and scutal margins being parallel to each other, the first, however, being much shorter than the second.

The *infra-median latus* is quadrangular, its height slightly surpasses its width.

The *carinal latus* has about the same area as the infra-median latus. The basal margin is straight, the carinal margin slightly hollowed out in its superior, and convex in its inferior portion. The lateral margin is also slightly hollowed out. The umbo projects over the hind margin of the capitulum; the umbones of the two carinal latera almost touch each other under the middle of the carina.

Length of the capitulum of the largest specimen 9·75 mm., breadth 5·5 mm.

The *peduncle* is short (3 mm.), cylindrical; eight calcareous scales form together a longitudinal row, of which there are about nine.

Mouth.—Labrum with the upper part highly bullate (Pl. VII. fig. 12) and the palpi elongate and very narrow, especially at the extremity, where they are furnished with some large bristles. *Mandibles* (fig. 13) with three teeth, equidistant from one another; the third tooth is sharply pointed. The lower edge of the mandible is broad and truncated, both edges of the truncated part bearing three small teeth. *Maxillæ* (fig. 14) rather narrow, with the spinose edge straight; all the spines are of about the same size, with the exception of the two uppermost ones, which are slightly greater. *Outer maxillæ* (Pl. VIII. fig. 5) rounded; the inner margin is sparingly hairy, the summit very hairy. The (so-called) olfactory orifices are placed at the extremity of a tubular process.

Of the *cirri* I wish to point out only that the first pair (Pl. VII. fig. 12) has very

unequal rami; the most anterior one is shorter and a great deal thicker than the posterior one. The former has five, the latter six segments.

This species was taken at Station 49, May 20, 1873; lat. 43° 3′ N., long. 63° 39′ W.; depth, 83 fathoms; bottom temperature, 1°·8 C.; bottom, gravel, stones. Numerous specimens. Station 10, cruise of H.M.S. "Triton;" August 24, 1882; lat. 59° 40′ N., long. 7° 21′ W.; depth, 516 fathoms. Bottom, mud; bottom temperature, 8° C. Two specimens.

Observations.—This species seems to be common throughout the northern part of the Atlantic Ocean. A very interesting observation was made in one of the specimens dredged in August 1882 by H.M.S. "Triton." On opening it, I found it contained eggs. They were large and not extremely numerous. On studying them with the microscope I found they had passed already the Nauplius-stage, and had arrived at the Cypris-stage. The exuviæ of the Nauplius-larva still adhered to the covering of the Cypris, though it was not easy to make out which parts had developed from the Nauplius-appendages. I figure an egg in the Cypris-stage in fig. 1 of Pl. VIII. The first pair of Nauplius-appendages changed into the antennæ of the Cypris, but of the two other pairs only one was visible. Whether its basal part has changed into one of the excrescences which fill up the interspace between the antennæ and the cirri, I cannot say with certainty. Of the cirri there are six pairs, behind which a rudimentary cirrus is still observed. They almost seem to have developed within that part of the Nauplius-larva which, as a distinct excrescence, is attached to the ventral side.

When complemental males are present there is one attached to the interior side of the scutum. Pl. VIII. fig. 4 shows the place it occupies (*a*). The chitinous membrane covering the valve on its interior surface forms a little pouch, the opening of which is directed towards the occludent margin of the valve. In this pouch the male is lodged. I got two rather different specimens of this male, and as I think our knowledge is still very insufficient in this respect, I give figures of both specimens. Probably the male figured in fig. 2 (Pl. VIII.) has not yet quite passed through its metamorphosis. At the one extremity it is furnished with the two small prehensile antennæ (*an.*), and at the other extremity a kind of disc is observed with an opening in it. The body is very flat. Muscles are seen running towards the antennæ, and probably the testis and the genital duct are represented. In the other stage (fig. 3) the animal has grown more robust; the body is no longer flat, but the size has slightly diminished: in the stage of fig. 2 the size is 0·8 mm., in that of fig. 3 only 0·6 mm. The disc-like appendage has disappeared, and the two prehensile antennæ are now represented by a single stout excrescence. As in the first stage, the chitinous membrane which covers the body is rather thick; it is, however, no longer so distinctly striated as was the case in the first stage. The internal viscera are much better to be distinguished; they are only represented by the genital apparatus. This consists of a glandular mass, the testis (*t.*) and a duct, which is much

swollen, and probably functions as a receptaculum seminis (*r.s.*). I think I have observed an opening near *o.*, but I do not feel quite sure.

Scalpellum carinatum, n. sp. (Pl. III. figs. 7, 8).

Valves fourteen; surface smooth; valves separated by broad chitinous interspaces. Carina bowed, with a flat roof, the apex of which, however, is not the apex of the valve which, therefore, is angularly bent. Upper latus of an irregular pentagonal shape. Infra-median latus large and wine-glass-shaped.

This species has about the same shape of carina as *Scalpellum japonicum* and *Scalpellum recurvirostrum*. This form stands between the carina with a perfectly flat roof (*e.g.*, *Scalpellum robustum*), and those with a distinct angularly bent carina (*e.g.*, *Scalpellum vulgare*). The species is represented by two specimens, only one of which, however, is full-grown.

The *capitulum* consists of fourteen valves, and is covered by a very thin, transparent chitinous membrane. The valves are separated by distinct interspaces of membrane. The capitulum is coloured dirty white, the interspaces have a yellowish-grey colour.

Scutum elongated, twice and a half as long as broad; apex pointed, basal margin oblique, forming a right angle with the occludent margin, but passing with a rounded angle into the lateral margin. This margin is slightly hollowed out, and is separated from the tergal margin by a not very large rectangular projection or shoulder. The occludent margin is very convex, the tergal margin is short and hollowed out. The umbo is at the uppermost point, where the valve shows a distinct triangular and feebly recurved projection.

Tergum large, triangular, flat, with the inferior part produced and the apex much recurved. The scutal margin has a small projection near the occludent margin, and this projection is placed behind the triangular projection at the apex of the scutum. The occludent margin is very much arched, the carinal margin is divided by a small projection near the apex into a small superior and a long inferior part, both parts being concave.

The *carina* in the inferior part is simply bowed, with a flat roof, much increasing in width from the upper to the lower end, and bordered on each side by a not very distinct ridge. The umbo is seated at the top of the flat roof and at a small distance from the apex of the valve. The part above the umbo is formed by the upward prolongation of the sides of the valve, which diminishes in size below, so as to terminate in a long point at the base of the carina.

The *upper latus* is irregularly pentagonal, flat; upper half acuminate, lying between the tergum and the scutum, the lower half broad. The umbo is not at, but near, the apex; the valve therefore is added to not only downwards but also a little round the two sides of the apex. These additions do not take place in the early stages of growth, and therefore, they form a depressed rim.

Scutum, tergum, and upper latus much resemble those of *Scalpellum rutilum*, Darwin.

Rostrum elongated and extremely narrow; quite enclosed between the two rostral sides of the rostral latera.

Rostral latera convex, with the rostral margin shorter than the arched infra-median margin, scutal margin slightly hollowed out, basal margin passing over with a rounded angle into the infra-median margin. Along the scutal margin a distinct ridge is observed, under which the valve is transversely hollowed out; a second ridge runs from the apex to the rounded infra-median margin.

The *infra-median latus* has the form of a wine-glass with a foot. The umbo is seated beneath the middle, hence the growth is for the greater part upwards; the valve is added to also round its rostral and carinal sides.

The *carinal latus* has almost the same shape as in *Scalpellum vulgare;* it is large, flat; the carinal margin is hollowed out, the basal margin passes over indistinctly into the lateral margin. The umbones of the two valves almost touch each other under the middle of the carina, and project over the base of the carina.

Length of the capitulum about 16 mm.; of the peduncle about 6 mm.

The *peduncle* is nearly cylindrical, with not very numerous scales at the surface. These are placed in about seven longitudinal rows, each row containing four to six scales. The scales are distinctly calcareous, hence white, and separated from each other by rather large intervals.

This species was taken at Station 135, near the Island of Tristan da Cunha; October 16–18, 1873; depth, 1000 fathoms; bottom, rock, shells.

Observations.—No complemental male was present in the specimen I investigated in a detailed manner. The relations of this species to the other species of the genus are rather complex. The form of the carina much resembles that of *Scalpellum japonicum*, but it differs from this species by the valves being completely calcified. The roof of the carina is flat as in the following section of the genus, but it has the umbo placed at a distance from the upper extremity of the valve.

Scalpellum recurvirostrum, n. sp. (Pl. III. figs. 11, 12; Pl. VIII. figs. 9, 10).

Capitulum covered by membrane. Valves fourteen, separated by broad membranous interspaces. Umbo of the carina at a little distance from the apex, hence the valve is slightly angularly bent. Upper latus trapeziform. Infra-median latus triangular. Peduncle cylindrical, with the calcareous scales scattered and at a considerable distance from one another.

Three larger and numerous very small and young specimens of this species were taken between Kerguelen and Heard Islands. It is middle-sized, and belongs to the same division of the genus as *Scalpellum vulgare*, Leach.

The *capitulum* is robust, about twice as long as broad, and not very flat. It is covered by a thin membrane, and the different valves are separated by broad chitinous interspaces. A distinct white line divides these interspaces into two equal parts, and marks the area of the different valves. Of these there are fourteen. The lines of growth are not distinct.

The *scutum* is elongate quadrangular; it is somewhat broader near its base than in the upper half. The umbo is at the apex, which slightly projects outwards, and which has a triangular, recurved, and pointed form.

The *tergum* is triangular. The occludent margin is much arched, hence the apex is distinctly recurved. The inferior part is a little produced.

The *carina* is bowed and internally concave; the portion above the umbo is very short, and not more than one-sixth of the total length. Since the roof is slightly convex, the sides of the carina pass over into the portion above the umbo.

The *upper latus* is trapeziform, with the scutal margin slightly hollowed out and not quite twice as long as the carinal margin. The apex is sharply pointed.

The *rostrum* is small, triangular, wedge-shaped.

The *rostral latus* is convex, four-sided, with the scutal and basal margins almost parallel and slightly hollowed out.

The *infra-median latus* is extremely small, triangular, with the umbo at the apex.

The *carinal latus* is flat, four-sided; basal margin nearly straight. Superior portion of the carinal margin slightly hollowed out, inferior portion short, lateral margin straight. The umbo is seated at the base of the carina and projects slightly outwards.

Length of the capitulum 13 mm.

The *peduncle* is cylindrical, and has a length of 7·5 mm. Very small and not numerous calcareous scales are scattered over its surface. At the place of attachment the foot of the peduncle grows wider.

Mouth.—Mandibles with three teeth, and the inferior angle pectinated, almost as in *Scalpellum intermedium*. *Maxillæ* (Pl. VIII. fig. 9) with a rather deep notch behind the first four spines, and a second less deep notch in front of the inferior angle. The second maxillæ have the so-called olfactory orifices at the end of long processes.

Cirri.—First pair with very unequal branches; the anterior and shorter branch has six rather broad segments, the posterior eight longer and more slender segments. The outer surface of the segments is extremely hairy. Of the other cirri nothing very characteristic has been observed.

The *caudal appendages* (Pl. VIII. fig. 10) are elongate and distinctly four-jointed; each segment bears two small spines at the extremity; the fourth is crowned by a tuft of about five stouter and two smaller bristles.

Penis short, rudimentary.

Complemental males not observed.

This species was taken at Station 150, February 2, 1874; lat. 52° 4′ S., long. 71° 22′ E.; depth, 150 fathoms; bottom temperature, 1°·8 C.; bottom, rocks.

Scalpellum compressum, n. sp. (Pl. III. figs. 13, 14).

Capitulum covered by a thick chitinous membrane, hence the limits of the valves can be only with difficulty made out. Valves thirteen, rostrum wanting. Umbo of the carina at a short distance from the apex, the valve therefore angularly bent. Sides of the carina extremely broad. Upper latus pentagonal.

This true deep-sea species is represented by a single specimen only. It is a highly characteristic form, constituting almost a distinct division of the genus by itself.

The *capitulum* is extremely flat, compressed, and consists of thirteen valves. An extremely small rostrum became visible as the thick chitinous membrane at the foot of the occludent margin of the scutum was taken away. I think it hardly advisable to consider it as a fourteenth valve. As the species is represented by a single specimen only, and as I was not permitted to sacrifice it, I have not isolated the different valves, which would have been the only way to ascertain their form. It was especially difficult to make out the valves of the lower whorl.

The *scutum* is not very large; its occludent margin is in length nearly twice the breadth of the valve; the lateral margin is about equal to the breadth of the valve. The scutum is divided into two triangular parts by a very prominent ridge. The umbo is at the apex, which is slightly recurved.

The *tergum* is triangular, with the occludent margin almost straight, and the carinal margin arched. The scutal margin is straight. The valve is divided into two parts by a very prominent ridge, which is itself flat and arched, the hollow side being turned towards the carina.

The *carina* has a narrow roof and broad sides. Near its base the roof is deeply furrowed, but this furrow disappears towards the upper extremity, where the roof is quite flat. That part of the carina which is situated above and in front of the umbo describes an obtuse angle with the roof, and runs almost imperceptibly into the margin of the tergum. The chitinous membrane which covers the carina is longitudinally striped.

The *upper latus* is pentagonal; the umbo is at some distance from the apex.

The *rostral latus* is quadrangular, the scutal margin hollowed out, the basal margin short, the rostral margin slightly arched.

The *infra-median latus* is narrow, its umbo at a short distance from the base. Beneath it there is a small triangular part, above it an elongated part. Perhaps the infra-median latus is much broader, especially towards the carinal latus.

The *carinal latus* is quadrangular, the carinal margin hollowed out. The umbo is seated near the base, and does not extend beyond the carina.

Length of the capitulum, 31 mm.

The *peduncle* is cylindrical, narrow, short (10 mm.); the scales are not calcareous, but yet their margins are very distinct. They form eight longitudinal rows, each containing about eight scales.

A single specimen of this species was taken at Station 198, October 20, 1874; lat. 2° 55′ N., long. 124° 53′ E.; depth, 2150 fathoms; bottom temperature, 3°·7 C.; bottom, red clay.

Observations.—I have not been able to investigate the structure of the mouth, of the cirri, of the caudal appendages, &c. With regard to the complemental males, I found on the interior surface of the right-hand scutum five of them attached close to the occludent margin. I have figured one of them (Pl. VIII. fig. 11). Their size is 1·3 mm. Their form is elongate, having the shape of a pear. The small antennæ (*an*) are distinctly to be observed, and consist of one segment only. The body is covered by a double wall, the exterior one forming a kind of mantle. Its outer surface is clothed with very small bristles, and at one extremity, the more swollen one, the external wall has an opening. The only organ which is well developed is the testis (*t.*), with its receptaculum seminis (*r.s.*). The testis is very large and heart-shaped; the receptaculum seminis is relatively small, and consists of an oval sac; at one extremity it communicates with the testis, at the other with the vas deferens. I tried in vain to distinguish where this duct opened; probably it is close to the opening of the mantle.

The specimen of *Scalpellum compressum* contained eggs. These are not very numerous, but relatively large. Their shape is oval, their length about 0·8 mm.

C. Species with the carina simply bowed.

a. *With a sub-carina.*

Scalpellum acutum, n. sp. (Pl. III. fig. 19; Pl. VIII. fig. 12).

Surface of the valves smooth, not covered by membrane. Valves thirteen. Carina simply bowed, very short. Umbo of the carina at the apex. A distinct sub-carina and a distinct rostrum are present. Only two lateral valves of the lower whorl at each side.

Of this extremely interesting species three specimens were taken at Station 170, 520 to 630 fathoms, and one specimen at Station 78, 1000 fathoms.

The *capitulum* is flat and elongate, and consists of thirteen valves. Besides the carina and the three pairs of upper latera, there are a rostrum, a sub-carina, and two pairs of latera of the lower whorl. Most of the valves have an elongate and pointed shape; the umbo of the rostrum projects outwards. The capitulum is not covered by membrane; near the base, however, small parts of a chitinous covering are still adhering to the valves.

The *scutum* is parallelogram-shaped, and divided into two triangular parts by a slightly

prominent ridge. The occludent margin is straight, and so are the other margins, with the exception of the lateral margin, which is slightly convex.

The *tergum* is elongate and triangular. The occludent margin is slightly convex, the apex a little recurved; the scutal margin is divided into two parts, describing together a very obtuse angle.

The *carina* is short, simply bowed; sides almost wanting, only slightly developed in the superior part. There is no flat roof, the valve being distinctly keeled.

The *upper latus* is trapeziform. The quadrangular part is enclosed between the scutum, the tergum, and the carina; the undermost and triangular part between the scutum and the carinal latus.

The *rostrum* is very large, much larger than the rostral pair of latera; it is internally concave and externally carinated; it is rhomboid, with the umbo at the apex, and resembles much the same part in *Scalpellum rostratum*.

The *rostral latus* is triangular and shorter than the rostrum, which valve it slightly overhangs.

The *carinal latus* is quadrangular, rhomboid. It is divided into two triangular parts by a prominent ridge running from the apex. The area of these valves almost equals that of the rostrum, and surpasses that of the rostral latus.

The *sub-carina* is triangular and rather small. The apex lies over the base of the carina.

Length of the capitulum, 5·5 mm.

The *peduncle* is narrow, only slightly wider near the capitulum, totally covered by very small scales, the free edges of which are rounded. The rows formed by the scales are not very regular.

Of one of the specimens I made a preparation of the *mouth*, which I figure on Pl. VIII. fig. 12. The mouth is not so bullate as in the other species; its opening is directed backwards. The œsophagus is narrow but very long; the supra-œsophageal ganglion is small and situated close to the cardia. The œsophageal commissure is very long, and the first ganglion of the ventral chord is large, the second a great deal smaller.

The first *cirrus* is elongate, its two branches are very unequal in length, but they are both very slender. The longest branch has ten, the shortest, eight segments. The oviduct opens at the base of this cirrus; it has a distinct swelling near its extremity, which no doubt corresponds to the well-known organ containing the so-called auditory sac in *Lepas*. Within this swelling, in the present species also, a small sac was observed.

Caudal appendages uniarticulate.

This curious species was observed at Station 78, July 10, 1873; lat. 37° 24′ N.; long. 25° 13′ W.; depth, 1000 fathoms; bottom, Globigerina ooze. Station 170, July 14, 1874; lat. 29° 55′ S., long. 178° 14′ W.; depth, 520 fathoms; bottom temperature, 6° C.; bottom, rocky. Lat. 29° 45′ S., long. 178° 11′ W.; depth, 630 fathoms; bottom temperature, 4° C.; bottom, rocky.

Observations.—This species is one of those which were collected at Stations situated far from one another. Whereas one Station is in the Atlantic, near the Azores, the other is in the Pacific, near the Kermadec Islands.

B. *Without a sub-carina.*

(A.) Species with a rostrum.

Scalpellum brevecarinatum, n. sp. (Pl. III. fig. 22).

Valves fourteen, covered by a very thin membrane only. Carina very short, simply bowed, with the umbo at the apex. Upper latus quadrangular. Valves of the lower whorl, and especially the carinal latera, large. Rostrum wedge-shaped.

Of this curious little deep-sea species two large and three very small and young specimens were collected. They agree with *Scalpellum balanoides* in the shortness of the carina.

The *capitulum* is flat, and consists of fourteen valves covered by a very thin chitinous membrane; in consequence of this the white colour of the valves has become slightly yellowish. The high development of the valves of the lower whorl is especially characteristic of this species.

The *scutum* is trapeziform; about twice as long as broad. The apex is slightly recurved, and projects over the tergum as a small triangular part. The occludent margin is arched, the lateral margin also; the tergal margin behind the projecting triangular part is straight.

The *tergum* is triangular; its occludent margin arched; the apex is recurved, the carinal margin slightly arched, the scutal margin almost straight. It surpasses the scutum in area.

The *carina* is short, simply bowed. The umbo is at the apex. The roof is not quite flat, and slightly furrowed longitudinally. In the uppermost portion small parts which must be considered as sides are visible.

The *rostrum* is elongate, narrow. The umbo is at the upper extremity, which is slightly narrower than the base.

The *rostral latus* is trapeziform. The scutal margin is much longer than the basal margin. The latter is straight, the former slightly hollowed out.

The *infra-median latus* has about the same shape as the rostrum. It is slightly protuberant over the surface of the other latera. Its umbo is at the upper extremity.

The *carinal latus* is very large and of an elongate pentagonal shape. The lateral margin is long and straight, the basal margin is rather short; the carinal margin is divided into a superior portion which is hollowed out, and into a rather long and slightly convex

inferior portion; the upper margin is straight. The umbo projects slightly over the carina. The two carinal margins touch one another over a long distance beneath the carina.

Length of the capitulum, 7 mm.

Peduncle short, conical. Scales large, calcareous; the edges very prominent. They are not numerous, and are placed in horizontal rows; vertically no distinct rows can be made out.

I opened one of the specimens, but the animal had been destroyed. I opened a second; it had the animal still within it, but its condition was very poor. So I am able to give only the following information.

The *labrum* is bullate; its free edge is furnished with a row of small but distinct and pointed teeth; the palpi are not very elongate, rather robust, furnished with hairs not only at the extremity but also at the sides. The *mandibles* have three teeth and a very short inferior angle, which is strongly pectinated. The *maxillæ* have the edge nearly straight; only a trace of a notch behind the very broad upper spines. The *outer maxillæ* have the bristles not divided into separate tufts. The so-called olfactory orifices are not placed on highly protuberant excrescences.

The first pair of *cirri* has unequal branches. The most anterior one is shorter and very thick, the posterior one is much more elongate; the latter has seven, the former five segments. A distinct interval separates the first cirrus from the five posterior pairs, which are much more elongate.

The *caudal appendages* are uniarticulate.

I found in one of the specimens a small complemental male attached to the interior surface of each scutum near its occludent margin. They were not in a condition fit for investigation.

This species was taken at two Stations, which, however, are close to one another:— Station 146, December 29, 1873; lat. 46° 46′ S., long. 45° 31′ E.; depth, 1375 fathoms; bottom temperature, 1°·5 C.; bottom, Globigerina ooze. One specimen. Station 147, December 30, 1873; lat. 46° 16′ S., long. 48° 27′ E.; depth, 1600 fathoms; bottom temperature, 0°·8 C.; bottom, Globigerina ooze. Three specimens.

Scalpellum parallelogramma, n. sp. (Pl. III. figs. 15, 16, and Pl. IX. figs. 1–5).

Surface of the valves covered by yellowish, chitinous membrane. Valves fourteen. Carina simply bowed, massive, with the umbo at the apex; the flat roof is bordered on each side by a distinct ridge, the flat sides are at right angles with the roof, which considerably increases in width from the upper to the lower end. Upper latera quadrant-shaped, with the arched side notched. Rostrum wine-glass shaped. Peduncle very short. Males three.

This is a very characteristic species, a dozen specimens of which were collected by the Challenger.

The *capitulum* consists of fourteen valves, and is robust; without the carina it has the shape of a parallelogram, hence the name which I propose for it. It has a considerable thickness at the lower end, but grows more compressed towards the upper end. The capitulum is covered by a strongly adhering yellowish chitinous membrane. The lines of growth are not very distinct.

Scutum more than twice as long as broad, trapeziform, the occludent and the lateral margins being parallel to each other. The umbo is situated at the apex, which slightly projects over the tergum; tergal margin slightly hollowed out. At the angle which the tergal margin describes with the lateral margin, a small projection is formed. The basal margin is straight.

Tergum triangular, flat, with a short and slightly arched occludent margin. Apex a little recurved, basal angle pointed. The area covered by the tergum smaller than that covered by the scutum.

Carina simply bowed, with a flat roof, increasing considerably in breadth from the upper to the lower end. On each side the roof is bordered by a strong ridge. Sides nearly at right angles with the roof, of equal breadth over its whole length, only growing narrower at the lower extremity.

Upper latus quadrant-shaped, with a not very deep notch cut out of the basal margin, which notch receives the upper margin of the carinal latus.

Rostrum minute, hour-glass shaped, the upper part being quadrangular, the lower being elongated-triangular; inserted like a wedge between the umbones of the rostral latera, so as to be easily overlooked.

Rostral latus quadrangular, the basal margin with a projecting ridge and slightly rounded.

Infra-median latus triangular and large. The under part on both sides is furnished with a kind of ala; the middle and under part formed by the inferior angle of the triangle projects considerably beyond the surface of the capitulum.

Carinal latus elongated, appears as if formed of two valves united together, both of a triangular shape with slightly curved sides. The umbo of the carinal latus projects very much beyond the line of the carina and also beyond the surface of the capitulum.

Length of the capitulum, about 21 mm.

Peduncle short (4 mm. in a specimen of 21 mm.), cylindrical, of the same width over its whole length, almost entirely smooth, at least not furnished with calcareous scales as in the other species.

Mouth.—Labrum with the upper and anterior part very bullate. *Palpi* small, almost triangular, not very slender. *Mandibles* (Pl. IX. fig. 1) with three teeth, the second and third smaller than the first. Inferior angle broad, pectinated. *Maxillæ* (Pl. IX. fig. 2) with a very deep notch behind the upper great spines, and about seven pairs of rather

equal spines at the nearly straight inferior portion of the free edge. *Outer maxillæ* (Pl. IX. fig. 3) with the bristles spread over the whole surface; one tuft, however, may be distinguished near the base on the anterior margin. The maxilla has a large rounded swelling directed forward, and a second smaller one at the back above the protuberances which bear the olfactory orifices (?) at their extremity.

The first pair of *cirri* has very unequal rami. The most anterior one has eight very broad segments, the posterior ramus has ten much more elongate segments. The surface of the segments is thickly clothed with very slender spines. At the base of the first cirrus the opening of the oviduct (Pl. IX. fig. 4, *g.o.*) is seen. It is placed below a small cover, of which it forms the hinder edge. The oviduct itself forms a swelling at the extremity, and a second even more prominent one a little before the extremity. This latter swelling (Pl. IX. fig. 5) contains a rounded bag, which no doubt corresponds to the auditory sac, as Darwin calls it, which in *Lepas* has the form of a little shoe.

The *caudal appendages* are elongate and multiarticulate. Those of the specimens I investigated were composed of seven segments.

Eggs large, 0·75 mm. in length, oval. The number of eggs contained in a specimen is not very large.

This species was taken at Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; depth, 600 fathoms; bottom temperature, 2°·7 C.; bottom, hard ground.

Observations.—This beautiful species is an inhabitant of the southern Atlantic Ocean. It lives attached to a coral of the genus *Dendrophyllia*. When complemental males are present, they are found in a considerable number (five or six) at the ordinary place. In shape the complemental male much resembles that of *Scalpellum compressum*. However, it is different, in as far as it is enclosed in a very tough, horny membrane, the mantle with the microscopic spines being found under this membrane.

Scalpellum album, n. sp. (Pl. III. figs. 20, 21).

Valves fourteen, white, smooth, interspaces between the valves broad. Carina simply bowed, with the umbo at the apex. Rostrum oval, rather large. Upper latus quadrangular, narrow.

This slender deep-sea species is represented by two specimens, the one probably full-grown, the other a great deal smaller and still young.

The *capitulum* is elongate, slender. At its base it has the same breadth as the peduncle, and it reaches its greatest width near the middle of the carina. The surface of the valves is smooth, only here and there chitinous fibres adhering to it. When studied with the microscope, the beautiful striation of the valves distinctly appears. The different valves, and especially the scutum, upper latus, and carina, are separated by

broad chitinous interspaces, which give the animal a very characteristic appearance. The capitulum consists of fourteen valves; there is a distinct rostrum, but no subcarina.

The *scutum* is elongate, very narrow, especially towards its upper extremity, hence almost triangular. The occludent margin is straight, the lateral margin also; the latter passes with a very obtuse angle into the short tergal margin. The basal margin is short. The umbo is at the apex, which projects considerably over the tergum.

The *tergum* is triangular, not very large, rather slender, obtusely pointed at the under extremity.

The *carina* is well developed, simply bowed, with the umbo at the apex. The apex reaches as far as half the length of the carinal margin of the tergum. The carina has no flat roof, being distinctly carinated; laterally it is regularly bowed, so as to show a semicircular line on section.

The *upper latus* is quadrangular and elongate. Its scutal margin is hollowed out, its tergal margin is short and straight; its carinal margin is straight also. The undermost part of the valve, which penetrates between the infra-median and the carinal latera, is a great deal narrower than the upper part.

The *rostrum* is relatively large, and has an oval shape. It is covered on either side by the free edges of the rostral latera, which touch each other in a single point beneath the occludent margins of the two scuta.

The *rostral latus* is quadrangular, with the rostral margin arched, and the scutal margin straight and a great deal longer than the basal margin; the lateral margin is large and slightly hollowed out.

The *infra-median latus* is elongate, triangular, with the umbo at the apex. The valve is distinctly protuberant beyond the surface of the two adjoining latera.

The *carinal latus* is relatively large, and has the umbo at the apex. Its carinal margin is distinctly arched, its upper margin hollowed out. The lateral margin is straight, and so is the basal margin. A very prominent ridge divides the valve into two triangular parts. The apex is considerably curved to the front, so as to touch the carinal-basal angle of the upper latus.

Length of the capitulum, 13 mm.

The *peduncle* is conical, being a great deal narrower near its attachment than near the capitulum; with the valves of the lower whorl the peduncle forms a kind of calyx for the reception of the other valves. The peduncle is covered by calcareous scales placed in six longitudinal rows, each containing about seventeen scales. The peduncle with its rows of scales has undergone a slight torsion.

Of this species I have not studied the structure of the animal enclosed within the capitulum; nor have I been fortunate enough to observe a complemental male at the place it ordinarily occupies.

This species was dredged at Station 214, February 10, 1875; lat. 4° 33′ N., long. 127° 6′ E.; depth, 500 fathoms; bottom temperature, 5°·3 C.; bottom, Globigerina ooze.

Observations.—This species from the Malay Archipelago, off Meangis Islands, is easily to be recognised, as well by the form of the capitulum as a whole, as by the shape of the different valves.

Scalpellum africanum, n. sp. (Pl. VI. fig. 14).

Valves fourteen, not separated by chitinous interspaces, covered by very thin membrane, which bears very minute hairs. Carina simply bowed, with the umbo at the apex; short, very broad near its inferior extremity. Upper latus quadrangular. Rostrum oval. Peduncle very short.

Of this species one probably full-grown and two or three small specimens were collected.

The *capitulum* is not very elongate, it is very thick and rather swollen between the valves of the lower whorl, flat again near the upper extremity. The length of the capitulum slightly surpasses once and a half its breadth. The surface of the capitulum is covered by a very thin membrane, which is thickly clothed with very minute hairs. The lines of growth of the different valves are distinctly visible under this membrane, and this applies especially to the tergum and the valves of the lower whorl.

The *scutum* is trapeziform, with the umbo at the apex. The latter is slightly recurved and projects over the tergum. The occludent margin is arched, the basal and lateral margins are straight; the length of the valve is not quite once and a half its breadth.

The *tergum* is triangular, with the apex slightly recurved. The occludent margin is arched, the scutal margin straight, the carinal margin hollowed out at its upper half and arched at the lower extremity.

The *carina* is boat-shaped, not so deep, however, in the lower as in the upper half. It is very short, and has the umbo at the apex. It is rather broad a little above its base, and from this broadest part a short triangular portion penetrates downwards between the two carinal latera. The sides of the carina are only little developed, they are placed as narrow semi-lunar strips near the tergum.

The *upper latus* is quadrangular; its tergal, scutal, and basal margins differ only slightly in length; its carinal margin, on the contrary, is a great deal shorter.

The *rostrum* is distinct and not very small. It is oval, and its free edges are covered by the rostral latera.

The *rostral latus* is small and almost triangular by the shortness of the basal margin. The scutal margin is the longest; it is distinctly concave, and the whole valve is bowed.

The *infra-median latus* is triangular, with the basal margin broad, and the umbo at the apex

The *carinal latus* is large and nearly pentagonal. Three of the margins are of about the same length; the basal margin describes a very obtuse angle with the lateral margin; the lateral margin forms nearly a right angle with the upper margin; the carinal margin is twice as long as one of the other margins; it is divided into two portions, the superior one is slightly hollowed out, the inferior one is slightly arched, and meets that of the valve of the other side at its under extremity. The umbo is placed at the angle which the two portions of the carinal margin describe together.

Length of the capitulum of the largest specimen not quite 7 mm.

Peduncle very short, totally covered by calcareous scales. These have very prominent edges, and are placed in eight longitudinal rows, each of them consisting of only five scales.

This species was taken October 17, 1873, off Nightingale Island, at a depth of 100 fathoms (Station 135, Island of Tristan da Cunha; bottom, rock, shells).

Scalpellum hirsutum, n. sp. (Pl. IV. fig. 19).

Valves fourteen, covered by membrane, clothed with very long hairs. Carina simply bowed, umbo at the apex, roof flat. Valves of the lower whorl small. Upper latus triangular. Rostrum represented by a very narrow stripe which is distinctly visible at the surface.

This small species is represented by a single specimen only.

The *capitulum* is characterised by the long hairs which clothe the membrane covering the valves. The valves of the lower whorl are rather small, the other valves—and especially the scutum and the tergum—are elongate, with produced apices.

The *scutum* is elongate, convex; more than twice as long as broad, with the upper part produced and pointed. The pointed extremity is slightly protuberant beyond the occludent margin of the tergum.

The *tergum* is large, elongate rhomboid. The umbo is at the apex, which is considerably produced.

The *carina* is simply bowed, and has a flat roof, much increasing in width from the upper to the lower extremity. Its sides are not much developed.

The *upper latus* is almost triangular, with the carinal-basal margin arched. The apex is slightly produced and is totally enclosed between the scutum and tergum.

The *rostrum* is small, linear-shaped; enclosed between the rostral margins of the rostral latera.

The *rostral latus* is quadrangular, basal and scutal margins parallel.

The *infra-median latus* is triangular; umbo at the upper extremity.

The *carinal latus* is of an irregular shape, with the umbo near the upper extremity.

Carinal margin arched, upper margin irregularly hollowed out; lateral and basal margins straight and almost of the same length.

Length of the capitulum, 6 mm.

The *peduncle* is short (about 2 mm.). The scales are placed in longitudinal rows, and slightly prominent.

I have not been able to study the animal contained in the capitulum, nor have I observed the complemental male of this species.

This species was taken at Station 196, October 13, 1874; lat. 0° 48′ S., long. 120° 58′ E.; depth, 825 fathoms; bottom temperature, 2°·4 C.; bottom, rock.

Observations.—This is one of the cases in which it must seem rather hazardous to propose a new species for a single specimen. However, I think it will prove possible to recognise the form by the aid of the figure and of the description.

Scalpellum nymphocola, n. sp. (Pl. III. fig. 23; Pl. IX. fig. 6).

Valves fourteen, smooth, covered by very thin membrane. Carina simply bowed, with the umbo at the apex. Rostrum visible at the surface. Upper latus pentagonal. Infra-median latus quadrangular. Peduncle almost as long as the capitulum.

Numerous specimens of this species were taken in 1880, by H.M. hired ship "Knight Errant." They are also richly represented in the collections made during the cruise of H.M.S. "Triton." In both cases they were found attached to the legs of *Nymphon robustum*, Bell, a stout Pycnogonid which is common in the cold water area of the Faröe Channel, and also in higher northern latitudes. In the Faröe Channel it is a common occurrence to observe the parasite on the legs of this Pycnogonid, whereas on the legs of true Arctic specimens the *Scalpellum* (hitherto at least and as far as my knowledge goes) has never been observed.

Capitulum thick, robust, oval shaped, the tergum slightly produced. Valves fourteen; covered by very thin membrane, and not presenting distinct lines of growth. Valves separated by distinct and rather broad chitinous interspaces. Scutum and upper latus short and broad, valves of the lower whorl rather large.

Scutum quadrangular, not quite once and a half as long as broad, convex. Umbo at the apex, which projects over the tergum.

Tergum triangular, occludent margin arched and a great deal shorter than the scutal margin.

Carina simply bowed, with the roof flat and the umbo situated at the apex. The sides of the valve are well developed, and only slightly broader near the upper extremity of the valve.

Upper latus pentagonal; in full-grown specimens the tergal margin makes a right angle with the scutal and also with the carinal margin.

Rostrum narrow, linear, short; laterally it is slightly covered by the edges of the rostral latus.

Rostral latus with the umbo slightly protuberant, of an irregular quadrangular shape.

Infra-median latus stout, almost as broad as it is high, pentagonal.

Carinal latus of an irregular shape. Umbo at one-third of the height of the valve from the base, slightly protuberant. Superior part of the carinal margin hollowed out, lateral margin long and at a right angle with the basal margin.

Length of the capitulum, 7½ mm.

Peduncle cylindrical, almost 6 mm. long, slightly thicker towards the upper extremity. The scales at considerable distances from one another placed in longitudinal rows. A full-grown specimen shows about seven of these rows, each containing about nine scales. Each scale is straight near its attachment, and has a rounded free edge.

Mouth.—The anterior part of the *labrum* forms an overhanging projection; the palpi are small, short, triangular, with a tuft of spines at the extremity. The *mandibles* have three teeth, the first and the second are separated by a very deep notch; the inferior angle is broad and strongly pectinated. The *maxillæ* show a not very deep notch behind the three upper spines, two of which are greater; the portion behind the notch has the edge nearly straight, and is furnished with five or six pairs of not very unequal spines. The *outer maxillæ* have the so-called olfactory orifices placed at the end of highly protuberant stalks.

The *cirri* in this species are relatively short; the first pair shows unequal rami; the shortest one has six segments, the longer ramus eight segments. Those of the former are slightly thicker than those of the other ramus. The segments of both rami are very thickly clothed with very long spines; the shortest ramus, moreover, shows a very thick spine on the outer side of the upper edge of the third and fourth segments, and two of these stronger spines near the upper edge of the fifth segment, and three at the extremity of the last segment.

The *caudal appendages* are small, uniarticulate.

The eggs are relatively large and not very numerous.

Complemental males (Pl. IX. fig. 6) one on each side, placed in a pouch formed by the membrane which covers the scutum interiorly. Its attachment and form is much like that of *Scalpellum stroemii*. The little body itself is covered by a very thin chitinous membrane, which is delicately striated. Of the inward parts almost nothing has remained except the testis and the receptaculum seminis. I could trace also—though not very distinctly—the course of the vas deferens, but I failed to distinguish the place where it opens.

Of this species great numbers were taken:—Cruise of the "Knight Errant."—Station 8, August 17, 1880; lat. 60° 3′ N., long. 5° 51′ W.; depth, 540 fathoms; cold area.

Cruise of H.M.S. "Triton."—Station 8, August 22, 1882; lat. 60° 18′ N., long. 6°15′ W.; depth, 640 fathoms; bottom, mud; temperature,—1°·1 C. Station 9, August 23, 1882; lat. 60° 5′ N., long. 6° 21′ W., depth, 608 fathoms; bottom, mud; temperature,—1°·1 C.

Observations.—In both cases the specimens were found attached to the legs of *Nymphon robustum*, Bell. However, we must not consider them as parasites of this species; the slowly moving legs of the Pycnogonid are for the Cirriped what branches of Bryozoa, Corals, &c., are for other species of *Scalpellum*.

This species comes very near to *Scalpellum angustum*, G. O. Sars. However, it is different in the shortness of the rostrum, which is covered on both sides by the rostral latera, and also in the form of the scales of the peduncle, which are placed at considerable distances from one another, and do not cover each other as roof-tiles do ("squamis sat magnis, niveis, vix imbricatis tectus," G. O. Sars; see also the figure of Heller, *loc. cit.*, Taf. iv. figs. 13, 14). The shape of the valves of the lower whorl is also different from those as figured by Heller. From *Scalpellum striolatum*, G. O. Sars, and *Scalpellum cornutum*, G. O. Sars, it is easily distinguished by the elongate form of the capitulum and the peduncle, and also by the shape of the infra-median latus.

Scalpellum rubrum, n. sp. (Pl. IV. fig. 18).

Valves fourteen, smooth, beautifully white and red coloured. Carina simply and strongly bowed, with a slightly convex roof and with the umbo at the apex. Rostrum triangular, distinct. Upper latus quadrangular, large. Valves of the lower whorl small. Infra-median latus triangular. Peduncle with very prominent ridges.

This very small species is represented by a single specimen.

The *capitulum* is flat, rather broad, and consists of fourteen valves. These are not covered by distinct membrane; those of the lower whorl are small, those of the upper part comparatively large.

The *scutum* has much the ordinary shape. Its occludent margin is arched, and forms with the tergal margin a triangular portion which projects over the tergum.

The *tergum* surpasses the scutum in area. Its carinal margin is much arched, its occludent margin almost straight.

The *carina* is well-developed, simply and rather strongly bowed; the roof is not quite flat, but laterally slightly convex. The sides are only slightly developed in the uppermost part.

The *upper latus* is quadrangular; the angle at the apex between the scutal and tergal margins distinctly projects over the scutum.

The *rostrum* is small, yet distinct. It has a triangular shape, its base being directed towards the peduncle.

The *rostral latus* is very low, quadrangular, the scutal margin nearly parallel to the basal margin.

The *infra-median latus* is small, triangular, and has the umbo at the apex.

The *carinal latus* is larger than the other latera of the lower whorl. Its carinal margin is arched, its upper margin hollowed out. Where the two margins meet, the umbo is situated; it is distinctly curved to the front. The lateral and basal margins are almost of the same length.

Length of the capitulum, about 5 mm.

The *peduncle* is about one-third the length of the capitulum, cylindrical; furnished with four longitudinal rows of very prominent scales, each row containing about five of these scales.

This species was taken at Station 204, November 2, 1874; lat. 12° 43′ N., long. 122° 10′ E.; depth, 100 fathoms and 115 fathoms; bottom, mud (near Luzon).

Observations.—The circumstance that only a single specimen of this species has been obtained makes it impossible to enter into details as to the structure of its mouth, cirri, &c. A complemental male was not present.

Scalpellum truncatum, n. sp. (Pl. V. fig. 13).

Surface of the valves naked, with very prominent ridges; valves fourteen, closely locked together. Carina simply and feebly bowed, with the umbo at the apex, and with the roof flat, much increasing in width from the upper to the lower extremity, bordered on each side by a very prominent ridge. Rostrum hardly visible. Tergum truncated. Upper latus trapeziform.

This species is represented by a single specimen. Its shape is a very characteristic one, on account of the truncated form of the tergum, the occludent margin of which describes an angle with the occludent margin of the scutum.

Capitulum very flat, consisting of fourteen valves. Valves entirely naked, with very distinct ridges and furrows over the surface; capitulum not very elongate, and having its greatest breadth about the scutal angle of the tergum.

Scutum with the umbo at the apex, which projects over the tergum; occludent margin almost entirely straight; basal margin short, at a right angle with the occludent margin; lateral margin convex; tergal margin slightly hollowed out. Valve divided into two triangular parts by a rather prominent ridge, which runs from the apex to the basal-lateral angle.

Tergum triangular; the occludent and scutal margins describe an angle of 90°. The scutal margin slightly undulating, the true scutal part being convex, the other hollowed out. The carinal margin is arched. The umbo is at the apex, where the occludent and carinal margins describe a rather obtuse angle.

Carina simply, though slightly, bowed. Roof flat, bordered by very prominent ridges, and increasing considerably in width from the upper to the lower extremity. Sides not very much developed, though slightly broader in the upper part of the valve.

Upper latus trapeziform, with the carinal margin straight and short, the scutal margin rather long and hollowed out, the tergal margin straight. The umbo is at the apex, which projects over the scutum. The scutal-basal angle is slightly truncated.

Rostrum extremely narrow, slightly increasing in width near the beginning of the occludent margin of the scutum.

Rostral latus quadrangular, with the scutal and basal margins parallel to each other, divided into two triangular parts by a ridge running from the umbo to the basal-lateral angle. Umbo slightly projecting over the occludent margin of the scutum.

Infra-median latus triangular, not very elongate, with the umbo at the apex, which is a little curved forward.

Carinal latus of a very irregular shape; a large triangular part is enclosed between the carina and the basal margin of the upper latus; the other part is quadrangular, with the umbo seated at the base of the carina, and slightly projecting over the hinder margin of the capitulum.

Length of the capitulum, 10·5 mm.

Peduncle short and cylindrical; about one-fourth the length of the capitulum. The scales are not very numerous nor very prominent. They do not form very regular rows, though three or four are placed longitudinally.

This beautiful deep-sea species was taken at Station 184, August 29, 1874; lat. 12° 8′ S., long. 145° 10′ E.; depth, 1400 fathoms; bottom temperature, 1°·8 C.; bottom, grey ooze.

Observations.—As only a single specimen of this species has been collected, my description is limited to the form of the capitulum and its valves. I do not doubt but that it will be possible to recognise the species with the aid of that description and of the figure.

Scalpellum elongatum, n. sp. (Pl. IV. figs. 8, 9).

Surface of the valves in full-grown specimens not covered by membrane, distinctly striated. Valves thirteen, or fourteen when the hardly visible rostrum is counted also. Carina simply bowed, with a flat roof deeply furrowed longitudinally, and with sides at right angles with the roof and well developed. Umbo of the carina at the apex. Upper latus quadrilateral, with straight sides. Lower whorl of the valves highly developed. Peduncle very short. Males numerous.

This is a beautiful species with a very flat capitulum. Its length is partly the consequence of the great development of the valves of the lower whorl. It is repre-

sented by a single full-grown specimen only. Though with hesitation, I refer also to it three other specimens taken at two different Stations.

The *capitulum* consists of thirteen valves. Between the two rostral sides of the rostral latera an extremely narrow calcareous streak is observed, which no doubt represents the rostrum, but which can hardly be said to be distinctly visible. In the largest specimen the surface is almost entirely naked; in the specimen which comes next in size, the surface is covered by a membrane richly furnished with woolly hairs. The smaller specimens from Station 169 are also hairy. As the shape of the valves, and especially the high development of the valves of the lower whorl, is the same in all these specimens, I feel inclined to consider the difference in hairiness as due to difference in age.

The *scutum* is large, quadrilateral, twice as long as broad. The lateral margin is straight, the basal margin slightly arched, the tergal margin straight, and has near the convex occludent margin a small triangular projection over the tergum. The umbo is at the apex. The lines of growth have two directions, and meet in a curved line running from the apex to the angle formed by the basal and lateral margins. The striæ are almost at right angles to the lines of growth.

The *tergum* is triangular, flat, large, with the three margins almost entirely straight; the carinal margin is the only one which makes an exception, as it is slightly convex in the undermost and slightly hollowed out in the uppermost half of its length. The striæ are diverging from the apex to the scutal margin; the lines of growth run parallel to the scutal margin. The umbo is at the apex.

The *carina* is simply bowed, with the umbo at the apex, and the roof deeply furrowed and bordered by strongly-developed lateral ridges. The roof increases considerably in width from the upper to the lower end; the two sides are flat and at right angles with the roof, they have the same width over their whole length.

The *upper latus* has the form of a trapezium, the carinal margin being almost exactly parallel with the scutal margin. The latter is three times as long as the former. The tergal margin has the same length as the basal margin. All the margins are straight and the umbo is at the apex. The lines of growth in the one part run parallel with the basal, and in the other parallel with the carinal margin.

The *rostrum* is not distinct.

The *rostral latus* is—when seen laterally—triangular; its real shape, however, is rather trapeziform. The umbo is at the rostral extremity, where the valve projects over the base of the scutum. The scutal margin is the prolongation of the basal margin of the upper latus. The hind margin is convex, and imperceptibly passes over into the short basal margin.

The *infra-median latus* is triangular, with the umbo situated at the apex, and the basal margin broad. The rostral and carinal margins are slightly hollowed out.

The *carinal latus* is very large, with the umbo seated at the basal outer angle; the

lateral and carinal margins run exactly parallel with each other, the lateral one being convex and passing over imperceptibly into the basal margin. The carinal margin is hollowed out. The carinal latera of the two sides meet each other under the middle of the carina. The valve is divided into two parts by a distinct concave ridge, running from the apex to the anterior basal angle of the valve.

Length of the capitulum, about 24 mm.

The short *peduncle* (5 mm.) shows well-developed and large scales. These are placed in six longitudinal rows, each row containing about seven scales.

As I did not wish to sacrifice the full-grown specimen, which has served for the above description of the exterior, I am not able to publish details of the structure of the mouth, &c. To give them from the smaller specimens does not appear to me to be a safe way.

The three Stations where this species was collected are the following:—Station 135, October 16 to 18, 1873; Island of Tristan da Cunha; depth, 60, 75, 100, 150, 550, 1000, 1100 fathoms; bottom—rocky, shells. Station 164A, off Sydney, June 13, 1874; lat. 34° 13′ S., long. 151° 38′ E.; depth, 410 fathoms; bottom, grey ooze. Station 169, off East Cape, Auckland, July 10, 1874; lat. 37° 34′ S., long. 179° 22′ E.; depth, 700 fathoms; bottom temperature, 4°·2 C.; bottom, grey ooze.

Scalpellum antarcticum, n. sp. (Pl. IV. figs. 16–17).

Capitulum covered by membrane, furnished with numerous though very small spines. Valves thirteen. Carina simply bowed, with the umbo at the apex and with a flat roof. Upper latus quadrangular. Umbo of the carinal latus almost at the base of the valve. Peduncle cylindrical, narrower than the base of the capitulum.

This is the most southern species of the genus taken by the Challenger. It is a medium-sized species, and it is represented by a single specimen only.

The *capitulum* is rather robust, convex. It contains thirteen valves; there is a trace of a fourteenth (the rostrum), but it is too rudimentary to be noticed. The valves are covered by a brown chitinous membrane, which bears numerous very small spines. Between the valves there are very narrrow chitinous interspaces.

The *scutum* is quadrangular, with the umbo at the apex. The whole valve is convex, especially in the undermost part. The occludent margin is arched, the lateral margin also; the basal margin is slightly arched, almost straight; the tergal margin, finally, is hollowed out.

The *tergum* is triangular, of a greater area than the scutum, with the apex recurved. The occludent margin is slightly arched.

The *carina* is rather stout. Its umbo is at the apex, and the whole valve is simply bowed. It has a flattened roof, which does not increase very much in width from the

upper to the lower extremity. The sides of the carina are at more than right angles with the roof; they increase much in width from the lower to the upper extremity.

The *upper latus* is quadrangular, with the lower angle truncated, hence pentagonal. The umbo is at the apex, which is slightly prominent. The scutal margin is hollowed out, the tergal margin slightly arched.

The *rostral latus* is of considerable size, quadrangular. Scutal and basal margins nearly parallel; the whole valve is distinctly convex and divided into two triangular parts by a not very prominent ridge running from the umbo to the basal lateral angle.

The *infra-median latus* is small, triangular. The umbo is at the slightly protuberant apex.

The *carinal latus* has an irregular shape, resembling that of a shoe. The umbo is at the carinal basal angle and represents the heel of the shoe. The carinal margin (the sole of the shoe) is slightly hollowed out. The upper margin is straight, the lateral margin is very short, the basal margin straight, only slightly upturned towards the umbo.

Length of the capitulum, 20 mm.

The *peduncle* is short (5·5 mm.), cylindrical, much narrower than the base of the capitulum.

The scales are covered by membrane, very narrow, transverse, calcareous stripes only being visible. They are not numerous, and do not form very distinct rows; they are at considerable distances from one another.

This species was taken at Station 153, February 14, 1874; lat. 65° 42′ S., long. 79° 49′ E.; depth, 1675 fathoms; bottom, mud.

Observations.—This species may be easily distinguished from the nearly related *Scalpellum velutinum*, *Scalpellum pedunculatum*, &c., by the form of the carinal latus. Though this valve also may perhaps present variations within the limits of a species, in the present case it can be safely made use of.

Scalpellum velutinum, n. sp. (Pl. IV. figs. 10, 11; Pl. IX. figs. 7–9).

Surface of the capitulum and of the peduncle covered by a velvet-like membrane. Valves fourteen, the rostrum, however, not visible at the surface. Carina simply and very strongly bowed, with the umbo at the apex, with a flat roof, the apex of which penetrates between the two terga. Upper latus triangular.

This beautiful species is represented by a single specimen. Provisionally there must be referred to the same species three smaller specimens, which were dredged near the southern point of Portugal; yet I am not quite sure that they belong really to the same species. This species is nearly related to *Scalpellum regium*, *Scalpellum darwinii*, *Scalpellum gigas*, *Scalpellum robustum*, &c., which form together a very natural group.

The *capitulum* has fourteen valves, and is rather robust; the scutum, tergum, and carina are large; the valves of the lower whorl are relatively small. The valves touch each other, and are covered by a distinct membrane with velvet-like hairs.

The *scutum* is exactly twice as long as broad, and distinctly convex. The umbo is at the apex, which slightly projects over the occludent margin of the tergum. The occludent margin is slightly convex, the tergal margin slightly hollowed out near the apex, the lateral margin is again convex, the basal margin straight.

The *tergum* is very large, rather narrow, with the carinal and scutal margins convex, the occludent margin hollowed out, and the umbo at the apex, which terminates bluntly.

The *carina* is simply bowed, with a flat roof widening much from the apex to the base. The umbo is at the apex, which penetrates rather far between the two terga. The borders of the roof are furnished with a not very prominent ridge; the sides are at less than right angles with the roof of the carina. They increase in breadth from the apex to the base.

The *upper latus* is triangular, the basal margin is feebly convex, the scutal and tergal margins are nearly equal; the umbo is at the apex.

The *rostrum* is very small and totally covered by membrane; it has a triangular shape, its apex being separated from the two scuta by the umbones of the rostral latera, which touch each other in front of the rostrum.

The *rostral latus* is broad but very low; the basal margin is almost parallel with the scutal margin.

The *infra-median latus* is triangular, with the umbo at the apex.

The *carinal latus* is of a very irregular shape, robust. Its carinal margin is divided into two portions, the superior one being hollowed out; the upper margin is also hollowed out for the reception of the convex margin of the upper latus. The umbo is at the hindermost point of the carinal margin, and projects a great deal outwards. The inferior portion of the carinal margin of the valve is convex, and meets the same portion of the margin of the valve of the other side beneath the middle of the carina. From the umbo arises a ledge, which divides the valve into two parts,—the true lateral and a carinal part. Between the latter and the carina a distinct cavity—a kind of bag—is formed.

Length of the capitulum, 33 mm.

The *peduncle* is robust, nearly cylindrical, and has a length of 12 mm. The scales are for the greater part covered by membrane, the edges only being calcareous. The membrane is villous, as on the capitulum. The scales are numerous, a dozen being placed in each longitudinal row, of which there are about ten. Their number cannot be distinctly made out, the longitudinal rows running rather obliquely.

In general this description holds good also for the three small specimens dredged at Station 3. They differ slightly from the typical specimen described above in the form of the carinal latus, and much more with regard to the number of scales of the peduncle. The

first distinction, viz., that the carinal latus is flatter and has the umbo not so far projecting outwards, may arise from the difference in age, hence in size. Yet the largest specimen of the three is probably a full-grown one, as it is furnished with a complemental male at each side. The difference in the number of scales of the peduncle is very considerable. Whereas the number of horizontal rows is about equal to that of the full-grown specimen of Station 335, the number of scales in each horizontal row is only three or four.

The complemental males of this species are relatively large; there are not more than one on each side. One of these (attached to the left hand scutum of the largest specimen of Station 3) is still in the pupa-stage. I have figured it Pl. IX. fig. 7. It has all the characteristics of a true pupa of a Cirriped; however, one feels inclined to say that the interior of the body is only feebly developed. The specimen figured in Pl. IX. fig. 8 has been taken from the right hand scutum of the full-grown *Scalpellum velutinum* from Station 335. In this male the retrogressive metamorphosis is already far advanced. The body is covered by a mantle clothed with numerous slender spines, and having two openings or slits, one anteriorly, through which the prehensile antennæ are stretched forth, and the other at the posterior extremity, which lets out a tuft of very delicate hairs. These hairs were originally attached to the six pairs of rowing feet of the pupa, but of these feet only the exuviæ are still visible. Of the interior of this young male the testis (*t.*), with a part of the vas deferens, is easily distinguished, and so are two glandular bodies, which, to judge from their position, probably represent the cement glands (fig. 8, *c.gl.*). The complemental male taken from the right side of the largest specimen from Station 3 is a well-developed one. At least its metamorphosis is finished, and the body, enclosed by the mantle with its slender spines, contains a large testis, with well-developed receptaculum seminis. I have figured this male in fig. 9 of the same plate. With regard to the size of the different stages, the length of the pupa-stage of fig. 7 is 1·3 mm.; the more advanced pupa-stage of fig. 8 measures only 1·1 mm., and the well-developed male of fig. 9, 1·2 mm. So we see that the size during the retrogressive metamorphosis slightly diminishes.

When we consider 1st, that it has been proved that in *Scalpellum stroemii*, Sars, the metamorphosis of the Nauplius-larva into the Cypris takes place within the mantle cavity of the mother; 2nd, that a larva in the Cypris-stage in different species of the genus *Scalpellum* (*Scalpellum velutinum*, *Scalpellum eximium*, &c.) has been observed at the place occupied also by the complemental male; and 3rd, that stages forming a link between the larva and the male itself have been observed at the same place—we may trace the life-history of these males in the following words:—

a. Species of the genus *Scalpellum* (whether all of them, or only those which inhabit the deep sea, cannot be said with certainty) have lost the Nauplius as a free swimming larval stage.

b. After the metamorphosis into the Cypris-stage, some of them become

attached to the interior side of the scutum of a female specimen near the occludent margin.

c. Whereas in the shallow-water species (*Scalpellum peronii*, Gray, sp.) these Cypris-larvæ develop into a small male animal, with a distinct capitulum and peduncle, in many deep-sea species they develop by retrogressive metamorphosis into a male of a much more rudimentary condition.

d. Neither in the first nor in the second case can it be said that unisexuality is observed in a stage which corresponds to the Cypris-stage of the ordinary development (see p. 17).

This species was taken at Station III. January 15, 1873; lat. 37° 2′ N., long. 9° 14′ W.; depth, 900 fathoms; bottom, Globigerina ooze. Station 335, March 16, 1876; lat. 32° 24′ S., long. 13° 5′ W.; depth, 1425 fathoms; bottom temperature, 2°·3 C.; bottom, Globigerina ooze.

Observations.—The two Stations from which this species was obtained are both in the Atlantic; the one (near Cape St. Vincent) has about the same northern latitude as the other (north of Tristan da Cunha) has southern latitude.

Scalpellum pedunculatum, n. sp. (Pl. VI. figs. 1, 2).

Valves fourteen, covered by membrane, clothed with numerous spines. Carina simply bowed, with the umbo at the apex and with the roof flat. Upper latus quadrangular, having the form of the sector of a circle. Carinal latus standing out very much beyond the surface of the carina.

This species is represented by a single specimen only; it belongs to the same division as, and is nearly related to, *Scalpellum velutinum*.

Capitulum triangular in outline, thick, especially near the peduncle. The valves of the lower whorl are very small and short. All the valves are covered by chitinous membrane bearing slender spines all over its surface. The number of valves is fourteen.

Scutum quadrangular, little more than once and a half as long as broad; apex slightly produced, and projecting over the tergum. Occludent margin arched.

Tergum triangular, occludent margin straight, carinal margin much arched, scutal margin slightly arched. In area the tergum slightly surpasses the scutum.

Carina with a flat roof, not very much increasing in width from the upper to the lower end, sides of the valve well developed, at angles greater than 90° with the roof of the valve. The sides increase in width from the upper to the lower end. Carina simply bowed, apex penetrating between the two terga, at a short distance from their apex.

Upper latus having the shape of the sector of a circle, though when looked at accurately, the basal and the carinal margins are seen to form an angle together, whence the valve is quadrangular. Scutal and tergal margins almost of the same length.

Rostrum very small, almost entirely hidden by membrane.

Rostral latus broad, but very low. Scutal and basal margins almost parallel.

Infra-median latus small, triangular; umbo at the apex, which is slightly protuberant over the surface of the capitulum.

Carinal latus of a very curious triangular shape. The umbo is protuberant beyond the surface of the capitulum, and stands out also laterally beyond the surface of the carina. The two carinal latera meet one another at the base of the carina.

Length of the capitulum, 18·5 mm.

Peduncle long (about as long as the capitulum), cylindrical, growing wider near the capitulum. It is covered by membrane clothed with spines. The scales are totally covered by this membrane, except in the lower part, near the attachment, where they project over the surface.

As this species is represented only by a single specimen, I have not studied its internal structure. I have also failed to observe the complemental male. The species inhabits the Pacific Ocean, near New Zealand, and was taken at Station 167, June 24, 1874; lat. 39° 32′ S., long. 171° 48′ E.; depth, 150 fathoms; bottom, grey ooze.

Observations.—This species is very nearly related to *Scalpellum velutinum*, *Scalpellum eximium*, *Scalpellum gigas*, *Scalpellum darwinii*, &c. Whereas all these species were taken at very considerable depths, *Scalpellum pedunculatum* is an inhabitant of rather shallow water.

Scalpellum eximium, n. sp. (Pl. IV. figs. 6, 7; Pl. IX. fig. 10).

Surface of the valves only partly covered by a chitinous and smooth membrane. Valves fourteen. Carina simply bowed, with a very broad flat roof, and with the umbo at the apex. Upper latus having the shape of the sector of a circle. Peduncle medium-sized, with very strong scales.

Of this splendid species only a single specimen was dredged; it belongs to the same group as *Scalpellum gigas*, *Scalpellum regium*, *Scalpellum darwinii*, *Scalpellum velutinum*, &c.

The *capitulum* is very robust, and is only partly covered by a thin chitinous membrane. There are slight interspaces between the different valves; a little broader is the interspace between the carina and the adjoining parts.

The *scutum* is quadrilateral and convex. The length is not quite twice the breadth. The umbo is at the apex, which slightly projects out of the occludent margin. From the

umbo to the angle where the basal and lateral margins meet, a curved line, with its hollow side towards the upper latus, marks the place where the valve is thickest; the lines of growth, which are rather distinct and run parallel to the basal and lateral margins, start from this curved line. The occludent margin is much arched, the tergal margin is hollowed out, the lateral margin is slightly arched, the basal margin is straight.

The *tergum* is very large, and has a much greater area than the scutum. It has an oval shape with a pointed apex and basal extremity. It is divided into two longitudinal parts by a slightly curved line running from the apex to the under angle. The lines of growth starting from this line run parallel to the scutal and carinal margins. The occludent margin is straight, the carinal margin arched; the scutal margin near the scutum is arched, near the upper latus hollowed out.

The *carina* is simply but very strongly bowed, the apex is at one-third of the length of the carinal margin of the tergum from the apex of the tergum. The roof is almost flat, being only slightly unequal through a not very distinct longitudinal ridge over the middle of the valve. On both sides the roof is bordered by a very distinct longitudinally furrowed ridge; the lateral parts of the valve are almost at right angles with the roof. The basal part of the roof of the carina is triangular, and penetrates as a wedge between the two carinal margins of the two carinal latera.

The *upper latus* is triangular, and has the shape of the sector of a circle, with a somewhat produced apex, however; its scutal margin is slightly hollowed out, its tergal margin is slightly convex.

The *rostrum* is very small and totally hidden under the chitinous membrane. Its exact shape I cannot describe, as I have not isolated it, and as the lateral parts are covered by the rostral latera.

The *rostral latus* has the umbo at the rostral extremity; here the apices of the two valves meet one another in front of the rostrum. The valve is short but broad, distinctly convex, divided by a ridge starting from the umbo.

The *infra-median latus* is triangular, with the umbo at the apex, which projects considerably beyond the surface of the other valves.

The *carinal latus* is of a very irregular shape, with the umbo strongly recurved and projecting beyond the surface of the valves, and slightly also beyond the line of the carina. The carinal margin is almost straight, those of the two valves meet at their base and at the same time at the base of the carina. A ledge starts from the umbo and divides the valve into two parts; the one is flat and situated at the base of the upper latus, the other is curved and divided by a second ledge again into two parts, the greater one being situated between the base and the carinal margin of the valve. This latter part is of a triangular form.

Length of the capitulum, about 43 mm.

The *peduncle* measures nearly 20 mm.; its surface is furnished with not very numerous

but much projecting scales, placed in rather irregular longitudinal and transverse rows.

Of the internal structure of the hermaphrodite (female) specimen I am not able to give details. Complemental males are present in numerous specimens, and are of different sizes. They are found attached at the ordinary place, and among them I found one which was still quite in the pupa-stage. I have figured (Pl. IX. fig. 10) one of the males, which had the largest size of all, and which may be safely considered as a full-grown (ripe) male. Its shape is elongate-triangular, its length 1·5 mm. The body is surrounded by a double wall; the outermost one represents the mantle, the interior one the true body-wall. The exterior one has anteriorly a slit; in that part of the body-wall which lies under this slit the male genital organs open. All the specimens have the two angles at the extremity of the shortest side of the triangle produced into conical excrescences, and a globular excrescence may be seen, moreover, between the two conical excrescences in the middle of the shortest side. The whole surface is covered by minute hair-like spines, much longer ones being present at the surface of the conical excrescences. The anterior half of the body, where the slit is present, has the spines of a very curious shape, as figured in fig. 10; each spine is triangular, the shortest edge being deeply cut in, hence each spine is furnished with numerous (three to seven) points. At the surface of each male is attached, moreover, a long and thin chitinous thread, which perhaps serves for the attachment to the scutum of the hermaphrodite specimen. Of the internal organs the male genital apparatus seems to be the only one which is left; it consists in the full-grown specimen of a rather voluminous testis, of a vas deferens, and of a receptaculum seminis. The latter opens with a short duct by the genital pore.

This species was taken at Station 135, October 18, 1873; off Tristan da Cunha; depth, 1000 fathoms; bottom, rock.

Observations.—The specimen was found attached to a piece of pumice-stone. At about the same place two other species of the genus (*Scalpellum elongatum* and *Scalpellum carinatum*) were taken.

Scalpellum gigas, n. sp. (Pl. IV. figs. 1, 2; Pl. IX. fig. 11).

Surface of the valves covered by a thin chitinous membrane, which is not villous. Valves fourteen. Carina simply bowed, rather massive, with the umbo at the apex, and a laterally slightly convex roof and two flat sides forming a slightly obtuse angle with the roof. Upper latus quadrangular. Carinal latus very high. Peduncle about half as long as the capitulum.

This species is no doubt very nearly related to *Scalpellum darwinii*, and I was long in doubt as to whether I should regard them as distinct or not. The smoothness

of the membrane covering the valves, the different shape of the carinal latera, the shortness of the peduncle, and finally, the totally different form of the complemental males, have forced me to describe and regard them as different.

Capitulum consists of fourteen valves, and is very flat. The membrane which covers the valves is thin, and permits the margins of the valves to be clearly seen; it is furnished with microscopic spines only. The upper parts of most of the valves are not covered by membrane.

Scutum broad, about once and a half as long as broad, convex, quadrilateral, with the occludent margin slightly arched; tergal margin hardly hollowed out, lateral margin almost straight, basal margin straight also; the angle where the lateral and basal margins meet is truncated for the reception of the apex of the infra-median latus. The umbo is at the apex, which slightly projects over the tergum.

Tergum long-oval, the area it covers is about equal to that covered by the scutum. A considerable part of the apex projects freely; it is truncated, having been broken off. The occludent margin is straight, the carinal margin arched, a little stronger than the scutal margin. Basal angle pointed.

Carina simply bowed, with the roof not quite flat, though flatter than in *Scalpellum darwinii*. Roof narrow at the upper end and gradually increasing downwards. Sides making with the roof an angle a little greater than 90°, showing almost the same breadth at the lower end as close to the apex.

Upper latus with a distinct though short carinal margin, hence quadrilateral. Basal margin arched.

Rostrum small, triangular, with the apex high up between the rostral sides of the rostral latera.

Rostral latus trapeziform, with the scutal margin parallel to the basal margin; the rostral angle not projecting beyond the scutum.

Infra-median latus triangular, with nearly equal sides and a long basal margin.

Carinal latus with the apex slightly recurved, triangular; with the upper margin hollowed out, and with the carinal margin distinctly convex. The basal margin is short, and forms an angle with the lateral margin. The basal part of the carina is triangular, and placed between the two carinal margins of the two carinal latera.

Lines of growth of all the valves as in *Scalpellum darwinii;* they may be seen in the figure.

Length of the capitulum, about 40 mm.

Peduncle little more than half as long as the capitulum (23 mm.), in both specimens of an irregular shape, caused by an excrescence in the largest specimen at the carinal side, and in the other specimens situated more laterally. In the upper part the transversely elongated scales are totally covered by membrane; in the lower part, however, they are distinct.

Of this species two specimens have been collected. The measurements of the one have been already given, the length of the other specimen was only 27 mm. for the capitulum and 12 mm. for the peduncle.

I have not studied the internal structure of this animal, but of the complemental males I may give the following description. I got three of them, which I found attached between the mantle and the left hand scutum, at a small distance from the apex. They are globular and rather small; their length is about 1 mm. They are covered by a mantle, which shows a very large slit, and which in the hindermost part of the body is confluent with the wall of the body. This hindermost part forms a globular excrescence, and causes the little male to look as furnished with a rudimentary peduncle. As rudiments of the prehensile antennæ, however, are present at the other extremity of the body, I think this comparison hardly admissible. The interior of the male is yet in an embryonic condition; a rather voluminous testis is present, but it is only just beginning to form spermatozoa, and the receptaculum seminis is still very small. The contents of the body for the rest consist of clear drops and of fatty corpuscles, which probably represent the remains of the deutoplasm of the embryo. The surface of the mantle is covered with microscopic spines, and the inner surface is beautifully striated.

This species was taken at Station 246, July 2, 1875; lat. 36° 10′ N., long. 178° 0′ E.; depth, 2050 fathoms; bottom temperature, 1°·3 C.; bottom, grey ooze.

Observations.—This is one of those cases (referred to already p. 28) in which a species was taken at a considerable distance from the shore, the Station, 246, being situated almost in the middle of the Pacific Ocean.

Scalpellum moluccanum, n. sp. (Pl. V. figs. 3, 4).

Valves fourteen. Surface of the valves covered by a chitinous and almost smooth membrane. Carina simply—not strongly—bowed, with the apex projecting freely, and the roof not flat. Umbo of the carina at the apex. Upper latus almost triangular. Peduncle middle-sized.

This species much resembles *Scalpellum regium* (Wyv. Thoms.), n. sp., and is also nearly related to *Scalpellum velutinum*, n. sp. It is represented by a single specimen only, and as this is not in all respects a sound one, I have been long uncertain whether I should describe it as a distinct species or not.

The *capitulum* consists of fourteen valves; the relative straightness of the carina gives the capitulum an oblong quadrangular appearance. The apex of the scutum projects freely as well as that of the carina. The capitulum is rather stout, and, especially towards the lower end, it is very thick. The valves are covered by a not very thick chitinous membrane, which

leaves the apices of the different valves uncovered, and is sparsely hairy. The scutum is rather more hairy towards the occludent margin. The lines of growth are not very distinct.

The *scutum* has the umbo at the apex, and has the shape of a trapezium, the occludent margin being the longer of the two nearly parallel sides. The apex of the valve is broken, but would have projected freely when present. The valve is, especially on the under side, distinctly convex. The lines of growth are not very distinct, and run partly parallel to the basal margin, partly to the lateral margin. The occludent margin is straight, the tergal margin hollowed out, the lateral margin is convex, the basal margin straight.

The *tergum* is large, having a greater area than the scutum; oval, with the upper angle broken off and therefore truncated, and the under extremity pointed and extending far down between the upper latus and the carina. The occludent margin is straight, the apex broken off and thus truncated; the carinal margin is distinctly arched, the scutal margin is arched as far as it runs at the side of the scutum, and slightly hollowed out near the upper latus.

The *carina* is simply but slightly bowed; from the apex to the basis it widens considerably. It has a distinct roof, which is not quite flat but slightly convex; the sides of the carina are at angles greater than 90° with the roof. The apex projects freely, but being broken it is impossible to judge of the extent of this free projection.

The *upper latus* is quadrangular, owing to the shortness of the carinal margin almost triangular, with the umbo at the apex, slightly but distinctly beaked, and projecting over the surface. The scutal margin is almost straight, only slightly hollowed out; the tergal margin is distinctly arched, the basal margin slightly convex.

The *rostrum* is almost totally covered by the chitinous membrane; it is very small and carinate; the lateral parts are covered by the rostral latera.

The *rostral latus* is broad but low, trapeziform, with the umbo at the rostral extremity. The basal margin is shorter than the scutal margin.

The *infra-median latus* is not very small, and of a triangular shape.

The *carinal latus* is medium-sized, and has the same shape almost as in *Scalpellum regium*, *Scalpellum darwinii*, and *Scalpellum velutinum*. The umbo is seated at the apex, which is beaked and slightly projecting outwards. A ledge arises from the apex, and separates a small oval depression from the upper latus. The carinal margins of the two carinal latera are convex, and touch each other at the base and below the middle of the carina.

Length of the capitulum about 33 mm., of the peduncle 16 mm.

The *peduncle* is stout, growing only slightly thinner towards the under extremity. The scales are placed in about nine longitudinal rows, and are totally covered by membrane. Transversely each row consists of eight scales.

No complemental males observed.

This species was taken at Station 195, October 3, 1874; lat. 4° 21′ S., long. 129° 7′ E.; depth, 1425 fathoms; bottom temperature, 3°·0 C.; bottom, grey ooze.

Observations.—It is extremely difficult to decide whether one is right in considering the specimen taken at Station 195 as specifically distinct from *Scalpellum regium*. After long hesitation, I have decided to do so, in the first place, because the capitulum as a whole has a more elongate shape; in the second place, because the chitinous membrane which covers the valves of *Scalpellum moluccanum* is smooth or almost smooth, whereas in most specimens of *Scalpellum regium* it is distinctly hairy. In the third place, the form of the upper latus is different, being a great deal broader in *Scalpellum regium* than in the present specimen. As in other similar cases, these differences may turn out—by intermediate forms being discovered—not to be of enough importance for creating different species. In that case our *Scalpellum moluccanum* will retain the significance of a so-called local variety.

Scalpellum regium (Wyv. Thoms.), n. sp. (Pl. IV. figs. 3–5; Pl. IX. fig. 12; Pl. X. figs. 1, 2).

Surface of the capitulum covered by membrane, which in some specimens is rather smooth, in others hairy. Valves fourteen. Carina simply bowed, with the roof laterally convex. Umbo of the carina at the apex. Upper latus quadrangular. Peduncle short. Complemental males numerous.

This is one of the largest species known. It is represented by numerous specimens, and was found at two different stations, which, however, are close to one another and have almost the same depth. This depth almost reaches 3000 fathoms. The different bottles containing this species are labelled *Scalpellum regium*, n. sp., or *Scalpellum regium*, Wyv. Thomson. Though no sufficient description of this species has been published, I retain the name given to it by the chief of the scientific staff on board the Challenger, the late Prof. Sir C. Wyville Thomson.[1] This name has been mentioned in another printed publication, viz., in a paper of M. Al. Humbert, inserted in the Journal de Zoologie, iii., 1874, p. 133. No doubt M. Humbert found the name in one of the letters sent by Dr. v. Willemoes Suhm to Prof. v. Siebold, and published in the Zeitschr. f. Wissensch. Zoologie, or else in the Reports from the Challenger.[2]

Capitulum with fourteen valves, which are covered by membrane, which in some of the specimens is almost entirely smooth, in others, however (and especially in the older specimens), it is rather hairy. The capitulum is very robust, almost quadrangular; very thick near the peduncle, and flatter towards the apex. The valves have their umbones at the apex, and show very distinct lines of growth. Tergum, scutum, and upper latus are very large; the valves of the lower whorl comparatively small.

Scutum trapeziform, only one and a third as long as broad. Convex, with the

[1] *Nature*, 1873, vol. viii. p. 347. Thomson, C. Wyv., Voyage of the Challenger, Atlantic, vol. ii. p. 4.

[2] *Proc. Roy. Soc.*, vol. xxiv., No. 170, p. 574.

occludent margin almost straight, the basal margin straight, the lateral margin slightly convex, and the tergal margin hollowed out. The umbo is at the apex, which in younger specimens is produced and pointed, in older ones broken off, hence blunt.

Tergum very large, triangular. The scutal margin is almost straight, only slightly convex; the occludent margin is straight, the angle which it describes with the scutal margin is a little greater than 90°. The third margin of the triangle is the carinal margin, which is very convex. It adjoins the carina for a little more than half its length; a considerable part therefore extends above the apex of the carina. In all the larger specimens the apex of the valve is broken off.

Carina very robust, with the umbo at the apex, which does not penetrate between the two terga. The carina is considerably bowed, and increases much in width from the apex to the undermost part. The roof is not quite flat but laterally rather convex. The sides of the valve are not much developed, and are about at right angles with the roof. The lower extremity of the valve is triangular, and penetrates between the two carinal margins of the carinal latus.

Upper latus large, quadrangular, with the scutal and tergal margins almost of the same length, and the carinal and basal margins also nearly equal. The umbo is at the apex.

Rostrum very small; it is separated from the opening between the two scuta by the umbones of the rostral latera. The shape of the rostrum is nearly oval.

Rostral latus broad but rather low; it has the shape of a trapezium, the basal and scutal margins being the two parallel ones. A ridge starting from the umbo divides the valve into two triangular parts.

Infra-median latus triangular, with the umbo at the superior extremity.

Carinal latus of a rather irregular shape, and much resembles that of *Scalpellum gigas*. The umbo is at the apex, which is beaked and distinctly recurved. The upper margin is hollowed out, the carinal margin convex. A rather prominent ridge is given off from the apex, and divides the valves into two triangular parts; of these one is a distinct latus, the other belongs rather to the carinal side of the capitulum. The latter part is divided into two parts by a less prominent ridge, which divides that half into two unequal parts, the narrower being the one which is separated from the carina by the carinal margin. In the full-grown specimens the carinal margins of the carinal latera meet each other at the base of the carina; in the younger they seem to be separated from each other by a narrow and uncalcified or incompletely calcified part, which probably represents a sub-carina.

Length of the capitulum 37 mm., breadth 26 mm.

Peduncle rather short (22 mm.), cylindrical, robust; covered by membrane. Scales numerous in the superior part, totally covered by the membrane; in the inferior part only their edges are distinctly visible. Scales placed in numerous (eleven) longitudinal

rows, each row containing about sixteen scales. Surface of peduncle furnished with very long and delicate bristles.

Mouth.—(Pl. X. fig. 1), *Labrum* bullate, with an anteriorly projecting and rather flat part. *Palpi* robust, with very numerous hairs at the extremity and on the outer surface; their shape resembles that of the last joint of the human thumb. *Mandibles* with three teeth, nearly equal, the first being only slightly longer than the two following ones. The inferior angle broad, rounded at the extremity, which is flat and indistinctly pectinated. The outer surface of the inferior angle is furnished with very delicate hairs. *Maxillæ* elongate, not very narrow. Free edge (Pl. X. fig. 2) without any notch; however, neither straight, being slightly excavated in the superior and slightly convex in the inferior half. The free edge is beset with a double row of strong spines; the superior angle shows only one great spine. It is much thicker but only slightly longer than the other spines. *Second maxillæ* with a rounded lobe at the anterior margin furnished with numerous hairs. The hindermost part of the outer surface over almost the whole length is also furnished with very long and slender hairs or bristles. Orifice of the so-called olfactory organ not placed on a long tubular process.

Cirri.—First pair with the rami unequal; the most anterior one has eight broader the posterior ramus twelve narrower, segments. The second pair has also unequal rami; one of twenty-one, and one of twenty-four segments. The other cirri have equal rami. The caudal appendages are relatively large, four-jointed, and furnished with a tuft of very long hairs at the extremity. There are also rows of very long hairs on the anterior margins of the other segments.

Penis wanting.

Eggs large (greatest diameter 1·03 mm., shortest 0·87 mm.); united in two flat masses, each of which contains two layers of ova. Number of eggs in each packet about 200.

Complemental males numerous. They have a long cylindrical shape, and are of a very simple structure (Pl. IX. fig. 12). In one of the full-grown specimens those of the one side numbered about half a dozen, those of the other side four. I have been able to study their anatomy by transverse sections. Details will be given in the third part of the present report. The length of the males is about 1·7 mm. They are covered by a mantle densely beset with very numerous spines. At the one side this mantle has a slit through which the rudimentary antennæ peep out. The opening of the genital apparatus is at the other extremity of the little animal. The structure of the genital apparatus shows the same parts as in the complemental males of the other species,—testis, receptaculum seminis, vas deferens.

Scalpellum regium (Wyv. Thoms.), n. sp., was dredged at two Stations. Station 61, June 17, 1873; lat. 34° 54′ N., long. 56° 38′ W.; depth, 2850 fathoms; bottom temperature, 1°·5 C.; bottom, grey ooze. Station 63, June 19, 1873; lat. 35° 29′ N., long. 50° 53′ W.; depth, 2750 fathoms; bottom, grey ooze.

Observations.—This species seems to be rather common at very great depths in the Atlantic Ocean. As far as known at present, these are the deepest places inhabited by Cirripedia. As well by the structure of the female (and hermaphrodite?) as by that of the male specimen, the species closely resembles other species living at a considerable depth, and also some from much lesser depths. The deep-sea species, as a true typical specimen of which the present form must be regarded, have no distinct character of their own. The very rudimentary condition of their complemental males is observed in some of the shallow-water species also.

Scalpellum regium, var. *ovale* (Pl. V. figs. 5, 6).

Together with six specimens of *Scalpellum regium*, a specimen was dredged, which in most respects resembles the typical species, but which differs from it in general shape and in the length of the peduncle. Its capitulum is not quadrangular but long-oval, and this is caused by the greater length of the carina, the apex of which is situated at a small distance from the apex of the tergum. The tergum itself is a great deal smaller, and has about the same area as the scutum. The carina has the sides almost undeveloped. Of the valves of the lower whorl, the rostrum is small and very narrow; the rostral latus and the infra-median latus much resemble those of *Scalpellum regium*. The carinal latus, however, is a great deal larger; higher in the first place. Moreover, the ridges which divide the same valve in *Scalpellum regium* into distinct triangles are by no means so distinct in the variety. At the carinal side the two valves are separated by a membranous part, which probably represents the sub-carina.

The length of the capitulum in the only specimen is 31 mm., whereas the peduncle measures 22 mm. The capitulum is covered by membrane, but even when studied with a lens this membrane appears smooth, that is, not hairy as in the typical specimens. The peduncle has an irregular cylindrical shape; the scales are distinct in the inferior part of the peduncle, but totally covered by membrane near the capitulum. There are about eleven longitudinal rows, some of which number on less than twenty scales.

This variety was furnished with a complemental male, which was still in the pupa-stage. This, however, is no reason, I think, why we should consider the specimen as a young specimen of *Scalpellum regium;* for, in the first place, I often observed males in that condition attached to the same female together with well-developed males, and in the second place, because one of the specimens of *Scalpellum regium*, the capitulum of which measured only 25·5 mm., was furnished with as many as four well-developed males.

The animal was taken at Station 61, June 17, 1873; lat. 34° 54′ N., long. 56° 38′ W.; depth, 2850 fathoms; bottom temperature, 1°·5 C.; bottom, grey ooze.

Scalpellum darwinii, n. sp. (Pl. V. figs. 1, 2; Pl. X. figs. 3–5).

Surface and borders of the valves almost hidden under a thick villous membrane. Valves fourteen. Carina simply bowed, massive, considerably increasing in width from the upper to the lower part; with the umbo at the apex, and with the roof convex and gradually passing into the sides. Upper latus having the form of the sector of a circle of about 50°. Peduncle rather long. Males four.

This is the largest species of *Scalpellum* known. Only a single specimen of it was dredged during the cruise of the Challenger.

Capitulum consisting of thirteen valves, the carina being the only single one. Valves covered by a brownish and very thick membrane, which, however, on the carina, tergum, scutum, and upper lateral valve, diminishes in thickness from the lower to the upper end, the latter in consequence being marked out by a lighter colour.

Scutum broad, not quite twice as long as broad, convex, quadrilateral, with the occludent margin the longest; tergal margin slightly hollowed out, lateral margin slightly convex. The umbo is at the uppermost point of the valve; the lines of growth run parallel with the basal and lateral margins. The apex does not project over the tergum.

Tergum large, having a greater area than the scutum; flat, oval, with the apex truncated (having been broken off), and the basal angle pointed. The occludent margin is straight, the carinal margin distinctly arched, the scutal margin being arched also, but not so distinctly. Lines of growth not very distinct.

Carina simply bowed, boat-shaped, with a rounded keel. Very broad near the lower extremity, gradually growing narrower towards the upper end. Sides nearly as broad at the lower end of the valve as close to the apex. Lines of growth oblique, meeting in the median line.

Upper latus triangular, large, with the apex pointed, the umbo being near the apex. The side which is opposed to the apex, and which is composed of the carinal and the basal margins, describes a beautiful curved line.

Rostrum represented by an extremely small and very narrow valve between the rostral angles of the rostral latera. Totally hidden under the chitinous membrane.

Rostral latus trapeziform, with the scutal margin almost parallel to the basal margin; the rostral angle slightly projects beyond the scutum.

Infra-median latus triangular, with nearly equal sides and a long basal margin.

Carinal latus large, of an irregular shape, subtriangular, umbo projecting outwards, the apex being distinctly beaked. A ledge starting from the apex describes a curve, and separates a small depression from the basal margin of the upper latus. The carinal margin is slightly convex, the triangular basal part of the carina being placed

between the carinal margin of the two carinal latera. Lower margin considerably convex; upper margin slightly concave.

Length of capitulum, about 46 mm.

Peduncle long (31 mm.), stout, growing wider towards the upper end, though even here by no means attaining the width of the capitulum. Whereas the capitulum is, especially in the upper part, much flattened, the peduncle is circular in section. The peduncle is also covered by membrane; the transversely elongated scales therefore not very distinct, a little more so in the lower part of the peduncle.

Fig. 3.—*Scalpellum darwinii*, attached to a nodule of manganese.

The accompanying woodcut (fig. 3) shows the way in which the only specimen of this species was attached to a manganese nodule. These nodules, Mr. Murray informs me, are formed by concretionary depositions around sharks' teeth, pumice, and other substances at the bottom.

I have not studied the structure of the animal contained within the valves. I found four complemental males attached between the mantle and the scutum, at a short distance from the apex of the valve and close to its occludent margin. Three specimens were on the left and one on the right side. They have the same shape as those of *Scalpellum regium*, but they are considerably larger, having a length of 2·7 mm. Small prehensile antennæ indicate the anterior extremity of the body, the opening of the genital duct being at the other extremity. The great size of the males enabled me to make preparations of their anatomy; with the aid of which the figures on Pl. X. are drawn. The wall of the body is distinctly seen under that which represents the mantle; muscles are attached to the former, and the latter is covered by very minute bristles.

This species was taken at Station 299, December 14, 1875; lat. 33° 31′ S., long. 74° 43′ W.; depth, 2160 fathoms; bottom temperature, 1°·1 C.; bottom, grey mud.

(B.) Species without a Rostrum.

Scalpellum distinctum, n. sp. (Pl. VI. figs. 10, 11).

Valves thirteen, not covered by membrane, separated from each other by distinct chitinous interspaces. Carina with the umbo at the apex, simply bowed, with a flat roof

furrowed longitudinally. Upper latus large, hexagonal. Infra-median latus large, wine-glass shaped. Scutum almost triangular. Peduncle cylindrical, with minute and very prominent scales.

This species is extremely characteristic through the form of its scutum and of its upper latus. It is represented by a single specimen only.

Capitulum of an elongate-oval shape, flat, consisting of thirteen valves only. The valves show distinct lines of growth, and are separated from each other by rather broad chitinous interspaces.

Scutum triangular, caused by the lateral margin being almost a prolongation of the short basal margin. Occludent margin arched. Tergal margin rather long, a triangular portion is described at the lateral extremity of the tergal margin by this margin, and by the uppermost part of the lateral margin. This triangular portion penetrates between the upper latus and the tergum, where it is received into a small excavation. Umbo of the scutum at the apex, which is slightly turned upwards.

Tergum triangular, with a not very long occludent margin. Carinal margin slightly arched, scutal margin slightly hollowed out. A triangular portion at the basal angle penetrates between the upper latus and the carina.

Carina not very strongly and simply bowed. Roof flat, not increasing much in width from the upper to the lower extremity; bordered by distinct ridges, hence the surface appears longitudinally furrowed. Sides at right angles with the roof, not very wide, but of the same width over the whole length of the carina.

Upper latus irregularly hexagonal, rather large. Its umbo is seated a little above the middle of the scutal margin.

Rostral latus irregularly quadrangular. Scutal margin almost straight, lateral margin describing an S-shaped line, rostral margin straight, basal margin straight also.

Infra-median latus having the form of a wine-glass. The foot is small, triangular, and the umbo is seated at the base of a much larger and wider portion.

Carinal latus irregularly quadrangular. Umbo at the foot of the carinal margin, slightly protuberant beyond the edge of the carina. Carinal margin hollowed out, upper margin short and oblique. Lateral margin hollowed out, basal margin well-developed.

Length of the capitulum, 15·5 mm.

Peduncle short, 5·5 mm., covered by very small and numerous calcareous scales, placed in not very regular rows. On some of the longitudinal rows thirteen or fourteen scales may be distinguished. The scales have very prominent and rounded free edges. The chitin of the peduncle may everywhere be seen between the scales.

Structure of the animal not studied; complemental male not observed.

The species was taken at Station 218, March 1, 1875; lat. 2° 33′ S., long. 144° 4′ E.; depth, 1070 fathoms; bottom temperature, 2°·1 C.; bottom, Globigerina ooze.

Scalpellum minutum, n. sp. (Pl. V. fig. 12).

Valves thirteen, with their surface covered by thin membrane. Valves thin and brittle. Carina simply and not very strongly bowed, with the umbo at the apex. Infra-median latus oblong quadrangular. Upper latus pentagonal.

This very small species is represented by a single specimen only. It comes near to *Scalpellum novæ-zelandiæ*, and belongs to the same division of the genus as that species, and as *Scalpellum flavum*. It may be distinguished from these species by the form of the carina almost at first sight.

The *capitulum* is very flat, the valves are covered by very thin membrane, and do not show distinct ridges of growth.

The *scutum* is elongate, quadrangular, almost twice as long as broad. The umbo is at the apex, which is slightly protuberant beyond the occludent margin of the tergum.

The *tergum* is stout, and surpasses the scutum in area. Its apex is recurved, the occludent margin being slightly arched.

The *carina* is not so long as in *Scalpellum flavum*, and is almost straight. The roof is flat, and does not increase considerably in width from the upper to the lower extremity. The umbo is at the apex, which almost penetrates between the two scuta; the roof shows a small thickened portion near its apical extremity.

The *upper latus* is pentagonal, being truncated at the angle formed by the basal and scutal margins.

The *rostral latus* is triangular; its rostral margin is arched, its scutal margin hollowed out, its lateral margin arched also.

The *infra-median latus* is narrow, being only slightly wider near the upper extremity. It is an impossibility to distinguish the place where the umbo is seated; it is probably close to the base.

The *carinal latus* has an irregular shape. Its carinal margin is hollowed out in the superior portion, and its umbo is situated at a considerable distance from the base. Hence, there is a well-developed inferior portion of the carinal margin also. Lateral and upper margins of the same length and almost straight.

Length of the capitulum, 6 mm.

The *peduncle* is very short, not quite 2 mm. Some very small scales are developed at the upper extremity of the peduncle; they are wanting near the lower extremity.

Structure of the animal within the capitulum not studied; complemental male not observed.

This species was taken at Station 302, December 28, 1875; lat. 42° 43′ S., long. 82° 11′ W.; depth, 1450 fathoms; bottom temperature, 1°·5 C.; bottom, Globigerina ooze.

Observations.—I cannot say with certainty whether the specimen taken at Station

302 is indeed a full-grown one. As in many of the other cases in which I propose a new species for a single specimen, it has only been done because it was an utter impossibility to consider it as a specimen of one of the better established species. Future investigations, conducted upon a richer material, will alone be able to decide this question.

Scalpellum abyssicola, n. sp. (Pl. VI. fig. 12).

Surface of the valves covered by a very thin membrane, almost smooth. Valves thirteen; they are thin and brittle. Umbo of the carina at the apex. Carina simply but strongly bowed, with the roof flat. Upper latus hexagonal, very large. Infra-median latus oblong, quadrangular.

This species is represented by a single specimen only. It is a small and rather elongate species, in many respects resembling *Scalpellum novæ-zelandiæ*, *Scalpellum flavum*, &c.

Capitulum elongate, surface unequal, a distinct gibbosity being observed near the middle of the upper latus. The occludent margin is very slightly arched, the carinal margin much more distinctly. Valves thirteen; the chitinous membrane which covers their surface is very thin.

Scutum quadrilateral, elongate, large. Occludent margin slightly convex, tergal margin a little hollowed out, apex—where the umbo is—slightly projecting over the tergum. Lateral margin hollowed out at the superior extremity and slightly convex in the inferior part. Basal margin slightly convex also.

Tergum elongate, triangular. Occludent margin slightly convex, scutal margin slightly hollowed out, carinal margin again convex.

Carina elongate, with a flat roof regularly though not very strongly increasing in width from the upper to the lower extremity. Sides well-developed, but more so in the upper than in the lower half of the valve. The sides are about at right angles with the roof. Umbo of the valve at the apex.

Upper latus rather large. Tergal and carinal margins almost straight, basal margin consisting of two parts,—a larger and slightly arched one separating it from the carinal latus, and a smaller straight one against which the infra-median latus is placed. The scutal margin follows the margin of the scutum, against which it is placed.

Rostral latus, as the other latera of the lower whorl, rather high. Caused by the shortness of the basal margin, the shape of the valve is nearly triangular. The rostral margin is straight, and placed against the same margin of the valve of the other side; the scutal margin is slightly hollowed out, the lateral margin is again slightly convex.

Infra-median latus hour-glass-shaped, with the umbo about in the middle of the valve. The basal margin is only a little broader than the upper margin.

Carinal latus large, penetrating with its upper part between the carina and the upper latus. Lateral margin convex, carinal margin hollowed out in the uppermost portion, the inferior portion being nearly straight, basal margin as long as the inferior portion of the carinal margin.

Length of the capitulum, 8 mm.

Peduncle short, about one-third the length of the capitulum. Totally covered by scales, which are placed on very regular longitudinal rows. Each of these rows, of which there are about seven, contains eight scales.

I have not been able to study the structure of the animal within the capitulum, nor have I observed the complemental male.

The species was taken at Station 246, July 2, 1875; lat. 36° 10′ N., long. 178° 0′ E.; depth, 2050 fathoms; bottom temperature, 1°·3 C.; bottom, grey ooze.

Scalpellum vitreum, n. sp. (Pl. V. fig. 14).

Surface of the valves smooth, not covered by membrane, beautifully striated. Valves thirteen. Carina simply, only slightly, bowed, with the roof flat. Umbo of the carina at the apex. Upper latus trapeziform. Infra-median latus small, triangular. Other valves of the lower whorl well-developed. Peduncle short.

This species is represented by a single specimen only. It is medium-sized, and belongs to the species with the valves of the lower whorl well-developed.

The *capitulum* is elongate, not quite twice as long as broad, very flat, and consisting of thirteen valves only. The surface of the valves is not covered by membrane, therefore smooth. The smoothness, however, is incomplete, as the valves are furnished with parallel and very delicate ridges, which are in a perpendicular or in a somewhat oblique direction to the lines of growth. The lines of growth are only very imperfectly visible.

The *scutum* is quadrilateral, with the occludent margin convex, the basal margin slightly hollowed out, the lateral margin straight, and the tergal margin straight also, and only slightly hollowed out in the anterior part. The umbo is at the apex, which is a little produced, and projects over the tergum.

The *tergum* nearly equals the scutum in size, its occludent margin is convex, the two other margins are nearly straight; the carinal margin is considerably longer than the scutal margin.

The *carina* is long and has a flat roof. At its inferior extremity this roof has a considerable width, which slopes towards the apex, where the umbo is situated. The sides in the undermost part of the valve are narrow and at right angles with the roof; in the superior part, however, they are broader, and at angles greater than 90° with the roof. Here these sides are delicately but very distinctly furrowed.

The *upper latus* is trapeziform, and has the four margins nearly straight. The scutal margin is the longest, the carinal margin the shortest of the four, the tergal and basal margins are almost of equal length.

The *rostral latus* is almost triangular, the lateral margin being almost the prolongation of the short basal margin. The umbo is at the extremity of the occludent margin of the scutum. The valve is indistinctly divided into two parts, by a ridge running from the umbo to the point where the lateral and basal margins meet.

The *infra-median latus* is triangular and rather narrow, and has the umbo at the superior extremity. This superior extremity does not reach the scutal-basal angle of the upper latus.

The *carinal latus* is large and almost trapeziform. The lateral and upper margins are almost of the same length, and the basal margin is only a little shorter. The carinal margin, on the contrary, is a great deal longer. It has the umbo at one-fourth of the total length from the inferior extremity. The part above the umbo is slightly excavated.

Length of the capitulum, 13·5 mm.

The *peduncle* is extremely short (3·5 mm.), conical, furnished with a membrane which covers the scales also. Hence these are only imperfectly visible. They form seven longitudinal rows, each of them composed of about eight rather large scales.

I have not studied the animal contained within the capitulum of this species, and complemental males were not present at the place they ordinarily occupy.

This species was taken at a small distance from Yeddo, at Station 237, June 17, 1875; lat. 34° 37′ N., long. 140° 32′ E.; depth, 1875 fathoms; bottom temperature, 1°·7 C.; bottom, mud.

Observations.—This species is nearly related to *Scalpellum truncatum*, *Scalpellum australicum*, &c. The form and structure of the valves, however, show its distinctness.

Scalpellum planum, n. sp. (Pl. IV. figs. 12, 13).

Surface of the capitulum smooth, covered by a very thin membrane. Valves thirteen. Scutum triangular. Carina simply bowed, with a flat roof and the umbo at the apex. Upper latus large, with the umbo near the middle of the scutal margin. Infra-median latus narrow, elongate.

This elegant little deep-sea species is represented by a single specimen.

The *capitulum* is elongated and very flat. Its greatest breadth is about in the middle, towards the peduncle it is a great deal narrower. The margins of the valves are very distinct. The carina is separated from the tergum by an interspace filled with chitinous membrane.

The *scutum* is almost triangular, the basal and lateral margins forming almost a continuation of each other. The occludent margin is slightly arched, the tergal margin is straight, the lateral and basal margins form together an undulating line. The umbo is at the apex.

The *tergum* is large, with the occludent margin convex, the scutal margin slightly hollowed out, and the carinal margin slightly convex in the undermost, and hollowed out in the uppermost, part. The umbo is at the apex, which is distinctly recurved.

The *carina* is simply bowed, with the roof flat. The roof only slightly increases in width from the apex towards the base, and is bordered on each side by a distinct ridge. The valve is furnished with distinct lateral parts, which are at right angles with the roof, and increase much in width from the base upwards.

The *upper latus* has a very characteristic shape, with the umbo seated about in the middle of the scutal margin. It has about the shape of the greatest half of a pentagon, and it is limited by five sides; the longest is the scutal margin, then follows the carinal margin, then the margin between this valve and the carinal latus, then the tergal margin, and finally comes the shortest of all, viz., the margin between it and the rostral latus. The third and fifth together form the basal margin of the valve.

Of the valves of the lower whorl, the rostral and carinal latera, though not very wide, are well-developed; the infra-median latus, however, is extremely narrow.

The two *rostral latera* meet one another below the occludent margin of the scuta, with long rostral margins. The umbo is at the apex, and projects distinctly over the edge of the scutum. Each rostral latus is divided into two triangular parts by a ridge running from the apex to the hindermost edge of the basal margin.

The *infra-median latus* is extremely narrow; its umbo is seated at a small distance from the apex, and projects a little over the surface of the valve. The valve slightly increases in width from the apex to the base.

The *carinal latus* is pentagonal. Its umbo is at the base of the carina, and projects distinctly over the hinder margin of the carina. The valve is divided into three triangles by two ridges starting from the umbo. Of these triangles the uppermost is by far the greatest. The carinal margin is divided into two parts, one above the umbo hollowed out and longer, the other beneath the umbo short and nearly straight.

Length of the capitulum, 12 mm.

The *peduncle* is short, 3 mm. only, and totally covered by calcareous scales. Of these about eleven are placed in a longitudinal row, the number of these rows being also about eleven. As a prolongation of the peduncle a chitinous membrane covers a part of the horny thread by which the specimen is attached, and this membrane presents also some small calcareous scales.

The structure of the animal contained within the capitulum has not been investigated, nor have I been able to make out whether complemental males were present or not. In

this and in other cases where the object is small and only a single specimen is present, the fear of spoiling the specimen made me unwilling to dissect it.

This species occurred at Station 160, March 13, 1874; lat. 42° 42′ S., long. 134° 10′ E.; depth, 2600 fathoms; bottom temperature, 0°·2 C.; bottom, red clay.

Observations.—This species shows much resemblance to *Scalpellum distinctum*, dredged from a depth of 1070 fathoms in the Pacific Ocean north of New Guinea. The different shape of the valves of the lower whorl, and also of the scutum, has made me consider them as different species. The difference in depth is also considerable, but this alone would by no means be of sufficient importance to separate the species.

Scalpellum australicum, n. sp. (Pl. V. fig. 11).

Surface of the valves naked, with slightly prominent ridges. Valves thirteen, closely locked together. Carina with the umbo at the apex, simply bowed, with the roof flat and bordered on each side by a rather prominent ridge. Upper latus trapeziform. Inframedian latus narrow, elongate. Umbo of the carinal latus projecting beyond the carina.

Of this species only a single specimen was collected; from the same locality a specimen of *Scalpellum dubium*, and one of *Scalpellum truncatum* were obtained.

Capitulum flat, consisting of thirteen valves. Valves naked, with distinct ridges and furrows. There are no distinct interspaces between the different valves. The shape of the capitulum is elongate-oval.

Scutum slightly convex, with the occludent margin arched; the tergal margin is feebly undulating, being hollowed out near the apex and convex towards the lateral margin. The umbo is at the apex, which projects over the tergum; the lateral margin is very irregular, the umbo of the upper latus projecting a great deal over the scutum. The basal margin is rather short, straight, and at an angle less than 90° with the occludent margin.

Tergum triangular, with the occludent margin arched, the carinal margin undulating, and the scutal margin rather irregular. The umbo is at the apex, which is distinctly recurved.

Carina simply bowed, with the roof flat and bordered by distinct ridges; sides at about right angles with the roof, and much broader near the upper extremity of the valve.

Upper latus trapeziform, with the apex, where the umbo is seated, projecting very much over the scutum. Carinal margin short, scutal margin hollowed out, basal-scutal angle truncated.

Rostral latus irregularly quadrangular. Lateral margin straight and rather long, scutal margin hollowed out, basal margin short. The umbo is at the rostral upper angle of the valve, and projects over the occludent margin; from the umbo a curved

ridge runs towards the posterior basal angle. This ridge divides the valve into a larger lateral and a smaller rostral part.

Infra-median latus extremely narrow, with the umbo near the base; the part above the umbo is comparatively large and wedge-shaped, the part below the umbo is small and triangular.

Carinal latus quadrangular, with the umbo projecting considerably beyond the carina. The carinal margin is hollowed out, the upper and lateral margins are straight. The basal margin is rather long, the lowest parts of the carinal margins of the two carinal latera touch one another under the middle of the carina. From the umbo a curved ridge runs to the anterior basal angle of the valve.

Length of the capitulum, 12·5 mm.

Peduncle slightly conical, being a little wider near the capitulum than near the base. It is very short (little more than 2 mm. long). The scales are prominent and not numerous, each longitudinal row contains no more than seven, and there are five of these rows. The scales near the capitulum are distinctly larger than those near the base of the peduncle.

Of this beautiful little species I have not studied the internal structure of the animal, nor have I been able to observe the complemental male.

The species was dredged at Station 184, August 29, 1874; lat. 12° 8′ S., long. 145° 10′ E.; depth, 1400 fathoms; bottom temperature, 1°·8 C.; bottom, grey ooze.

Observations.—Scalpellum australicum is nearly related to *Scalpellum antarcticum*, *Scalpellum tenue*, and some other species. Future investigators examining a great number of specimens, will perhaps only regard as varieties what I believe to be distinct species.

Scalpellum tenue, n. sp. (Pl. IV. figs. 20, 21; Pl. X. fig. 6).

Valves thirteen, covered by a thin woolly membrane. Carina, with the umbo at the apex, simply and feebly bowed, with the roof flat. Upper latus trapeziform. Infra-median latus narrow, small. Umbo of the carinal latus not projecting beyond the carina. Peduncle cylindrical, short.

This species is represented by a single specimen only; in general shape it much resembles *Scalpellum antarcticum*. On closer examination it appears to be distinct.

Capitulum consists of thirteen valves; there is a trace of a rostrum, but it is too rudimentary to be considered as a distinct valve. The valves are covered by a thin woolly membrane; the lines of growth can only be followed indistinctly under that membrane. In general outline the valve is elongate-oval; at its base it is sharply marked off from the peduncle.

Scutum about twice as long as broad. Occludent and lateral margins nearly parallel;

umbo at the apex, which is produced and slightly recurved; it projects a little over the tergum.

Tergum triangular, stout, broad. Occludent margin long, arched. Apex recurved. Scutal margin almost straight, carinal margin straight in the under, hollowed out in the upper, part.

Carina very large, simply bowed, but almost straight. Roof flat, not bordered by distinct ridges. Sides of the valves at angles with the roof greater than 90°. These sides are broader near the upper extremity than near the lower end.

Upper latus quadrangular; the angle described by the scutal and basal margins truncated; hence the valve appears to be pentagonal. The apex slightly projects over the scutum.

Rostral latus quadrangular; the scutal and basal margins parallel. The valve is divided by a ridge into two triangular parts.

Infra-median latus does not reach the slightly truncated scutal-basal angle of the upper latus; narrow. Umbo at the upper extremity.

Carinal latus quadrangular. Carinal margin almost straight, umbo seated near the base and slightly protuberant; basal, lateral, and upper margins almost straight. Beneath the ridge, which runs from the umbo to the angle between the lateral and basal margins of the valve, only a very small triangular part is situated.

Length of the capitulum, 17 mm.

Peduncle cylindrical, rather narrow. Length of the peduncle, 5·5 mm. Scales almost totally covered by membrane, hence indistinct; their edges only are slightly protuberant beyond the surface of the peduncle.

The structure of the animal contained within the valve has not been studied by me. With regard to the complemental males of this species, the following may find a place here (Pl. X. fig. 6). At the interior of each scutum there is found one attached close to the occludent margin, between the adductor muscle and the tergal margin. The length of these complemental males is 1·1 mm., their breadth about 0·7 mm.; so their shape is a broad oval. The mantle which covers them is almost smooth on one side only; where the genital apparatus opens, it is furnished with very short spines. The structure of the interior is very simple; there is a very large heart-shaped testis, which at its pointed extremity communicates by a rather long duct with the receptaculum seminis. From this, as in the other species, a long vas deferens is given off which opens at the posterior extremity of the small body. The male is attached to the interior of the scutum by means of prehensile antennæ. The extremity where the genital apparatus opens forms a globular excrescence, the end of which bears some stronger spines.

Scalpellum tenue was taken at Station 146, December 29, 1873; lat. 46° 46′ S., long. 45° 31′ E.; depth, 1375 fathoms; bottom temperature, 1°·5 C.; bottom, Globigerina ooze.

Scalpellum indicum, n. sp. (Pl. VII. fig. 1).

Valves thirteen; covered by a chitinous and villous membrane. Carina simply and very strongly bowed, with the umbo at the apex, and with a flat roof not bordered by ridges. Upper latus quadrangular. Umbo of the carinal latus at the upper extremity of the carinal margin. Peduncle rather short.

Of this interesting little species only a single specimen was taken. It is an inhabitant of shallow water, but it resembles the true deep-sea species both in regard to the form of the carina and the carinal latus.

The *capitulum* is covered by membrane, which causes the margins of the different valves not to be everywhere distinctly visible. This membrane is furnished with short woolly hairs. The shape of the capitulum is elongate, the undermost half of the carinal side runs parallel with the rostral side. The surface on both sides is almost flat. The valves of the lower whorl are small. The rostrum is absent and the total number of the valves is thirteen.

The *scutum* is trapeziform and elongate; its occludent and lateral margins run parallel to each other, and are at right angles to the basal margin. The umbo is at the apex, which is slightly produced. The tergal margin is a little hollowed out, and is shorter than the lateral margin.

The *tergum* is oval, with the apex and the angle formed by the scutal and carinal margins pointed and slightly produced. The occludent margin is almost straight, and forms the continuation of the occludent margin of the scutum.

The *carina* is elongate, simply, rather strongly bowed, with the umbo at the apex. Its roof is flat and is not bordered by distinct ridges, for it passes almost imperceptibly into the very narrow sides of the valve. The breadth of the roof of the carina is not very considerable; its basal portion is triangular, and penetrates between the two carinal margins of the carinal latera.

The *upper latus* is quadrangular, and has the umbo at the apex. The scutal margin is straight, and is the longest of the four. The tergal and basal margins have almost the same length, whereas the first is nearly straight, the second is distinctly convex. The carinal margin is straight also, and a little shorter than the tergal margin.

The *rostral latus* is short but very broad. Its scutal and basal margins run nearly parallel to each other. Its umbo is at the base of the occludent margin of the scutum, where the rostral margins meet one another. The place where the umbo is is slightly protuberant beyond the rostral margin.

The *infra-median latus* is small, triangular. Its umbo is at the apex, which is slightly turned forward.

The *carinal latus* is almost triangular, which is the consequence of the lateral margin forming almost the continuation of the basal margin. The carinal margin is very convex,

the upper margin is hollowed out. The umbo is seated at the upper extremity of the carinal margin at the apex of the valve. The valve itself is divided by a ridge running from the umbo to the hardly distinct angle formed by the lateral and basal margins.

Length of the capitulum, 7 mm.

Peduncle robust; its length equals two-thirds of the length of the capitulum; covered by a very thick membrane. The scales are not very distinct. In the upper part of the peduncle they stand close to one another, in the lower part, however, they are separated by chitinous interspaces. Here they are protuberant beyond the surface of the peduncle.

Of this species I have not studied the structure of the animal contained within the capitulum; nor have I observed a complemental male at the place they ordinarily occupy.

This species was taken at Station 192, September 26, 1874; lat. 5° 42′ S., long 132° 25′ E.; depth, 129 fathoms; bottom, mud.

Observations.—This species, with regard to the structure of the valves and to the smallness of the valves of the lower whorl, is nearly related to the large deep-sea species *Scalpellum regium* and others. It is distinguished from these species by the absence of the rostrum.

Scalpellum tritonis, n. sp. (Pl. V. figs. 9, 10; Pl. X. fig. 10).

Valves covered by membrane, which is distinctly hairy. Valves thirteen. Carina simply and not very strongly bowed, with the roof flat and the umbo at the apex. Upper latus almost triangular, the carinal margin being very short. Valves of the lower whorl, with the exception of the carinal latus, not much developed. Peduncle short.

Together with some specimens of *Scalpellum stroemii*, this species was taken in the Faröe Channel, by H.M.S. "Triton." Mr. Murray asked me to insert the description of this species among those of the Challenger species.

The *capitulum*, though rather small, looks robust. Its shape is oval, a little elongate, as the apex of the tergum is produced. The number of the valves is thirteen; scutum, tergum, carina, and upper latus are well-developed; on the contrary, those of the lower whorl extremely small. The shape of the rostral latus resembles very much the shape of the same valve in those species which have the carinal latus with the umbo at the upper extremity of the carinal margin. The surface of the valves is covered by membrane, which bears numerous small hairs.

The *scutum* is convex, quadrangular. The basal margin is the shortest, and is straight, the occludent margin is arched, the tergal margin nearly straight, the lateral margin arched. The area of the valve is smaller than that of the tergum. The umbo is at the apex, which is slightly produced.

The *tergum* is triangular, large. The occludent margin is only little shorter than the occludent margin of the scutum; it is arched, hence the apex is slightly recurved. The

scutal margin is slightly convex in the middle. The carinal margin is the longest of the three; it is hollowed out in the upper, and convex in the lower portion.

The *carina* is simply bowed, large, and furnished with a flat roof. It only slightly increases in width from the upper to the lower end, and has well-developed sides at right angles to the roof. The breadth of these sides increases from the under to the upper extremity.

The *upper latus* is trapeziform, or by the shortness of the carinal margin nearly triangular. Its umbo is at its apex, which is produced and slightly protuberant over the scutum. The scutal margin is hollowed out, the tergal margin is convex, the basal margin is straight, the very short carinal margin is straight also.

The *rostral latus* is small, being only very low, especially at the rostral extremity, where the slightly protuberant umbo is situated. The height of the valve slightly increases towards the infra-median latus. A ridge, running from the umbo to the angle between the lateral and basal margins, divides the valve into two parts.

The *infra-median latus* is extremely small, triangular; it has the umbo at the apex, which is directed forward.

The *carinal latus* is rather large. The umbo is protuberant beyond the carina, and situated at a considerable distance from the apex; hence the carinal margin is divided into two parts, the larger above the umbo and a shorter part beneath it. The larger part, which is above the umbo, almost equals in length the upper margin of the valve, the lateral margin has about the same length as the smaller portion of the carinal margin. The basal margin is as long as the basal margin of the rostral latus.

Length of the capitulum, 10 mm.

The *peduncle* is cylindrical, rather robust, not quite 3 mm. long, and covered by hairy and thick membrane. The surface is beset with very protuberant scales, of which about seven form a longitudinal row, seven of these rows forming the covering of the peduncle.

Two specimens of this species were found in the Faröe Channel, at Station 10, cruise of H.M.S. "Triton," August 24, 1882; lat. 59° 40′, long. 7° 21′ W.; depth, 516 fathoms; bottom temperature, 8° C.; bottom, mud.

Observations.—This species is probably nearly related to *Scalpellum cornutum*, G. O. Sars. With regard to the structure of the complemental males, I can only say that in one of the specimens a male has been found attached to the interior side of each of the two scuta. However, the microscopic study of their organisation has given no results, because their preservation was rather bad. I have only been able to ascertain that they agree with the males of *Scalpellum intermedium* in the presence of two pairs of rudimentary valves. These valves, probably, represent the scutum and the tergum, and in the present species are not exactly of the same size; the shape of each is oval, but a larger and a smaller one are placed close to one another, and the two are separated by a somewhat greater distance from a quite similar couple of valves (Pl. X. fig. 10). This condition of the complemental male forms the transition from the structure of these males in

Scalpellum peronii, Darwin, and *Scalpellum villosum*, Darwin, to the much more rudimentary state of the males in *Scalpellum regium*, *Scalpellum darwinii*, &c. The surface of the male is clothed with rows of very minute spines.

Scalpellum novæ-zelandiæ, n. sp. (Pl. V. figs. 7, 8).

Surface of the valves covered by a very thin chitinous membrane. Valves thirteen. Carina simply bowed, with a flat roof and with the umbo at the apex. Upper latus quadrangular or rather pentagonal, the lower edge being truncated. Valves of the lower whorl well-developed. Infra-median latus elongate, quadrangular. Carinal latus large, elongate, with the umbo near the base. Peduncle short.

This little species is represented by a single specimen only. In general shape it much resembles *Scalpellum flavum*, yet I think it must be considered as specifically distinct.

The *capitulum* is elongate, flat, and consists of thirteen valves. The valves are not very close to one another, but are separated by narrow chitinous interspaces. A thin chitinous membrane covers the capitulum and adheres to its surface. Only here and there the calcareous surface of the valves appears. The elongate form of the capitulum is caused by the length of the other valves as well as by those of the lower whorl.

The *scutum* is quadrangular, not quite twice as long as broad. The umbo is at the apex, which is slightly produced and recurved, and covers a small part of the tergum. The occludent margin is arched, the basal margin also; the lateral margin is not distinct, the valve being covered here by the free edge of the upper latus.

The *tergum* is triangular, the umbo is at the slightly produced apex. The angle between the carinal and scutal margin is also produced, and nearly of the same size as the apical angle. The occludent margin is a little arched, and only a little shorter than the scutal margin.

The *carina* has the roof quite flat, and not very much increasing in width from the upper to the lower extremity. The sides are well-developed everywhere, almost of the same width and at right angles to the roof. The roof is considerably bowed.

The *upper latus* is irregularly trapeziform. The short carinal margin runs parallel with the longer scutal margin; the latter, however, is slightly hollowed out. The umbo of the valve is at the apex, which reaches over the scutum, as, though in a less degree, the whole scutal margin does. The angle formed by the scutal and basal margins is truncated, hence the valve pentagonal.

The *rostral latus* has the umbo at the upper extremity of the rostral margin. This margin is straight and rather long. The scutal margin is hollowed out, the short basal margin forms a rounded angle with the slightly arched lateral margin.

The *infra-median latus* is irregular, quadrangular, elongate, narrow. Its umbo is

placed a little beneath the middle, its rostral and carinal margins are slightly hollowed out about the height of the umbo.

The *carinal latus* is large, quadrangular. The umbo is situated near the base of the carinal margin, which is only slightly excavated for the reception of the basal portion of the carina. Its lateral margin is rather long, longer than that part of the carinal margin which is situated beneath the umbo.

Length of the capitulum, 7 mm.

The *peduncle* is short (not quite 2 mm.), cylindrical; the longest axis of the peduncle is not a continuation of the longest axis of the capitulum, but the two form an angle of about 135°. The surface of the peduncle shows rather prominent scales, which, however, are covered by membrane.

I have not studied the structure of the animal within the capitulum, nor have I observed the complemental male of this species.

The species was collected at Station 169, July 10, 1874; lat. 37° 34′ S., long. 179° 22′ E.; depth, 700 fathoms; bottom temperature, 4°·2 C.; bottom, grey ooze.

Observations.—The differences between this species and *Scalpellum flavum* will be given under that species.

Scalpellum dubium, n. sp. (Pl. IV. figs. 14, 15).

Surface of the valves covered by a very thin and hairy membrane. Valves thirteen, closely locked together. Carina simply bowed, with the umbo at the apex, with the roof not quite flat being slightly convex laterally, and not bordered by distinct ridges. Upper latus trapeziform. Infra-median latus triangular. Carinal latus rhomboid, with the umbo in the middle of the carinal margin.

This species is represented by a single specimen. Its capitulum is rather stout and flat; the carinal and rostral sides of the capitulum being nearly parallel, give it an almost rectangular shape.

Capitulum flat, covered by a thin membrane, which is much covered with hairs; the striæ on the valves, however, are not wanting, though more prominent on the valves of the lower whorl than on the others.

Scutum not very convex, with the lateral and occludent margins almost parallel; the tergal margin is slightly hollowed out, the umbo is at the apex, which projects over the tergum. The basal margin is straight, and forms an angle less than 90° with the occludent margin. Scutum about twice as long as broad, divided into two triangular parts by a ridge running from the apex to the basal-lateral angle.

Tergum triangular, with the occludent margin slightly arched, the carinal margin almost straight, and the scutal margin slightly and not very regularly undulating. The area of the tergum nearly equals that of the scutum.

Carina simply bowed, with the roof flat; the roof does not increase much in width from the apex towards the base; rather short, its base being at a considerable distance from the peduncle. The sides of the valve are much narrower in the undermost part than near the apex.

Upper latus trapeziform, in consequence of the shortness of the carinal margin almost triangular; umbo at the slightly projecting apex, scutal margin concave, basal and tergal margins almost straight.

Rostral latus irregularly quadrangular, with the umbo slightly projecting over the occludent margin of the scutum. Rostral margin short, lateral margin slightly arched.

Infra-median latus elongate-triangular, with the umbo at the apex, which is slightly bowed towards the rostral side.

Carinal latus irregularly rhomboid; the carinal margin has a short upper part, which is concave for the reception of the carina, and a convex and rather long lower part; the basal margin is very short. The umbo is at the base of the carina above the middle of the carinal margin, it is slightly projecting beyond the carina; the inferior parts of the carinal margins of the two carinal latera touch each other in the middle below the base of the carina. The carinal latus is divided into two triangular parts by a ridge running from the umbo to the angle near the apex of the infra-median latus.

Length of the capitulum, 18·5 mm.

Peduncle cylindrical, slightly bowed, and of considerable length (9 mm.). The scales are not very distinct and rounded at their free edge. There are seven longitudinal rows, each containing more than twelve scales.

I have not studied the structure of the animal within the capitulum. I have found one complemental male at the place it ordinarily occupies. It is rather large, being 1·8 mm. long, and it shows the structure of the complemental males of most of the deep-sea species. Its surface, however, does not show the little spines which ordinarily invest it. The receptaculum seminis was filled with thread-like spermatozoids.

This species was taken at Station 184, August 29, 1874; lat. 12° 8′ S., long. 145° 10′ E.; depth, 1400 fathoms; bottom temperature, 1°·8 C.; bottom, grey ooze.

Observations.—In this species the form of the carinal latus is highly characteristic. The ridge, which runs from the umbo to the point where the infra-median latus and the upper latus touch each other, divides the valve into two parts. The part which is placed beneath the ridge in shape almost entirely resembles the whole valve in *Scalpellum regium;* by the presence of the other part the valve, however, more resembles the same valve in *Scalpellum triangulare, Scalpellum brevecarinatum,* and others. Among the species of *Scalpellum* which have the carinal latus as in *Scalpellum regium,* and the valve as in the present species, *Scalpellum velutinum* (Pl. IV. fig. 10) may be placed; in this species the carinal latus shows a small triangular part between the ridge and the upper latus.

Scalpellum flavum, n. sp. (Pl. VI. fig. 9 ; Pl. X. figs. 7–9).

Valves thirteen, covered by a thin chitinous membrane. Carina very long, simply bowed, with the umbo at the apex and the roof laterally convex. Upper latus very large, quadrangular. Infra-median latus narrow. Carinal latus elongate, large, with the umbo near the base. Peduncle very short.

Three full-grown specimens of this little *Scalpellum* were brought up with the dredge, together with a specimen of *Scalpellum brevecarinatum*. The species is nearly related to *Scalpellum novæ-zelandiæ*.

Capitulum flat and elongate, and consists of thirteen valves. The valves are covered by a thin chitinous membrane ; they do not show distinct lines of growth. The elongate form of the capitulum is partly due to the length of the valves of the lower whorl, partly to the length of the other ones.

Scutum quadrangular, a little more than twice as long as broad. Umbo at the apex, which slightly projects over the tergum. Lateral and occludent margins almost parallel, only very slightly arched, basal margin slightly arched.

Tergum triangular, with the occludent margin short and the two others long. The scutal margin is straight, the carinal margin distinctly arched. The occludent margin is very slightly arched.

Carina simply, rather strongly, bowed ; very large ; the umbo, which is at the apex, reaches to a short distance from the apex of the tergum. The roof is not quite flat, but laterally slightly convex. The sides are about of the same width over the whole length of the carina.

Upper latus quadrangular, the carinal margin parallel with the scutal margin. The edge formed by the basal and the scutal margins is truncated ; hence the valve is, properly speaking, pentagonal. The scutal margin, at the end of which the umbo is placed, does not reach over the scutum.

Rostral latus almost triangular, the basal margin being very short. Umbo slightly protuberant beyond the occludent margin of the scutum. Scutal margin hollowed out. Lateral margin slightly arched.

Infra-median latus high and narrow ; umbo a little beneath the middle, where the valve is a little narrower still than at the upper and lower extremities.

Carinal latus of an irregular elongate shape. The lateral margin describes a very obtuse angle with the upper margin. A large triangular portion of the valve is enclosed between the upper latus and the carina. The carinal margin is slightly concave in the upper part. The umbo is at the base of the carina, and separated from the peduncle by the short lower part of the carinal margin. Basal margin rather long.

Length of the capitulum, 7·5 mm.

Peduncle very short and narrow, and not placed in the prolongation of the capitulum ; its direction forming an angle of about 135° with that of the capitulum. Scales pro-

minent with the edges rounded. Four or five are placed in a longitudinal row, of which there are about seven.

The study of the structure of the animal contained within the capitulum has yielded the following results.

Mouth.—Labrum bullate, with a row of small sharply-pointed teeth. *Mandibles* (Pl. X. fig. 7) with three teeth of nearly the same strength. Upper side of the third tooth serrated; inferior angle bearing about six strong teeth. *Maxillæ* (Pl. X. fig. 8) with the free edge straight, without any notch. The edge bears about twelve pairs of spines; the first two pairs are stronger and longer, the last three pairs are smaller than the remaining pairs. *Second maxillæ* have the so-called olfactory orifices on very long stalk-like excrescences. The anterior surface of the second maxilla bears very numerous spines.

Cirri.—The first pair has very unequal rami. The most anterior ramus is short, has only eight segments, and is rather broad. It is flat and has the shape of a table. The surface of the different segments is clothed with very numerous and slender spines, the hinder margin of each segment bears from three to six stronger spines. The segments of the posterior margin are more elongate, and as they are also more numerous than those of the other ramus (there are ten in the posterior ramus), the whole ramus is a great deal longer and more slender. The surface is also richly clothed with slender spines, but those of the hinder margin are by no means so strong, nor are they placed so regularly, as is the case on the anterior ramus. The other cirri are very slender. Those of the last pair have a two-jointed pedicel and branches of twenty-one to twenty-two segments. At the inner side each segment bears five pairs of spines: a first pair of extremely small spines, a second pair of not very stout spines, and three following pairs of long and robust spines.

The *caudal appendages* (Pl. X. fig. 9) are slender and elongate, sparingly clothed with spines. They have six, indistinctly seven segments.

The *complemental males* of this species are very small, their length being only 0·7 mm. Their structure is very simple, and much resembles that of the other true deep-sea species. They are placed, one at each side, between the scutum and the chitinous membrane; the little creature is almost totally embedded, and only a small rounded part is visible. This represents the peduncle. A rounded opening at the extremity shows the spot where the genital apparatus opens. The surface does not bear the spines, which in many other species are characteristic.

This species was dredged at Station 146, December 29, 1873; lat. 46° 46′ S., long. 45° 31′ E.; depth, 1375 fathoms; bottom temperature, 1°·5 C.; bottom, Globigerina ooze.

Observations.—This species differs from *Scalpellum novæ-zelandiæ* in the following regards:—1. In the upper latus not reaching over the scutum, and having the carinal margin longer; 2. In the roof of the carina, which is flat in *Scalpellum novæ-zelandiæ*, and convex in *Scalpellum flavum*; 3. In the length of the carina, reaching almost to the tip of the tergum in *Scalpellum flavum*, and by no means so far in *Scalpellum novæ-zelandiæ*.

Scalpellum balanoides, n. sp. (Pl. V. fig. 15; Pl. X. fig. 11; Pl. XI. figs. 1–3).

Valves thirteen, covered by thin membrane. Carina extremely short, simply, in fact hardly at all, bowed, without a distinct roof. Umbo of the carina at the apex. Upper latus triangular. Valves of the lower whorl extremely large. Carinal latus almost as high as the carina, with the umbo at the apex.

This interesting little *Scalpellum* is very remarkable by the size of the valves of the lower whorl, and has a curious shape in consequence of the great dimensions of its carinal latus.

The *capitulum* is flat, consists of thirteen valves, and is covered by a very thin membrane. The capitulum is narrow at the base, having there the same breadth as the peduncle; it is almost twice as broad in the middle, where, the carinal latus being very large, the base of the carina is to be sought for. From there it gradually slopes towards the upper extremity. Lines of growth of the different valves not very distinct.

The *scutum* is about twice as long as broad; the occludent margin is almost straight, and the umbo is at the apex of the rather sharp angle which is formed by the occludent and by the tergal margins. Tergal and lateral margins about of the same length, half as long as the occludent margin. Basal margin about at a right angle with the occludent margin.

The *tergum* is triangular, and nearly equals the scutum in size. The occludent margin is short, the scutal margin is middle-sized, slightly convex; the carinal margin is by far the longest and rather convex.

The *carina* is very short, simply, but not very strongly, bowed. The umbo is at the apex. There is no very marked limit between the roof and the sides of this valve, as is the case in the greater part of the other species.

The *upper latus* is triangular by the absence of a carinal margin. The area of the valve is not very considerable. The umbo is at the scuto-tergal angle. Scutal and tergal margins have the same length, the basal margin is a little longer.

The *rostral latus* is quadrangular. Umbo at the apex of the angle formed by the rostral and scutal margins. The basal margin is shorter than the nearly equal rostral and scutal margins. The lateral margin is a little longer than the rostral margin. A ridge running from the apex to the angle formed by the basal and lateral margins divides the valve into two triangular parts with different lines of growth.

The *infra-median latus* is elongate, triangular; the umbo is at the apex. The rostral margin is slightly concave, the carinal margin distinctly convex.

The *carinal latus* is very large. Umbo at the upper extremity of the carinal margin, convex. The carinal margins of the two valves are very long, and meet one another along nearly the whole length, beneath the base of the carina. The upper and lateral margins are nearly equal in length, the basal margin is short.

Length of the capitulum, 4·5 mm.

Length of the peduncle 2 mm. Surface of the peduncle covered by chitinous and rather prominent scales. Seven of these scales form a longitudinal row, of which there are in all five; one of these rows is placed carinally, the two other pairs both laterally.

Mouth of a very curious shape, chiefly in consequence of the great size of the second maxillæ (Pl. X. fig. 11). *Mandibles* with three teeth, the first smooth, the second and third serrated on the superior edge. Inferior angles sharply pointed, bearing six stout spines on the superior edge. The latter spines are placed very close to one another (Pl. XI. fig. 1). *Maxillæ* not very robust, slender, bearing short and not very numerous spines on the free edge. Beneath the first four spines (two of which are larger) a distinct notch is visible; the part beneath the notch is not protuberant, and bears short hairs. *Second maxillæ* very large, reaching far beyond the maxillæ (Pl. XI. fig. 2), furnished with hairs on the anterior margin.

Cirri slender and rather long. First pair with unequal rami, the shortest having six, the longest eight segments, the latter only slightly thinner than the former. Last cirrus with short segments bearing only two pairs of robust and one of very small spines at the anterior margin.

Caudal appendages elongate, very slender (Pl. XI. fig. 3), composed of twelve segments, and furnished with a few hairs only.

Penis well-developed, rather long, covered by minute hairs. Its length has not been determined, as the organ was broken off in the specimen I opened to study its organisation.

One of the specimens contained a small quantity—about twenty—of relatively large eggs. Their length only slightly surpasses their breadth (0·42 mm. and 0·35 mm.). They are all in the same stage of division, and there is no doubt that they are fecundated ova. As no complemental male was present at the place it ordinarily occupies, and as, moreover, this species was provided with a well-developed penis, I think it is very probable that minute dissection will show this species to be hermaphrodite, as most other Cirripedia are.

This species was taken at Station 192, September 26, 1874; lat. 5° 42′ S., long. 132° 25′ E.; noon; depth, 129 fathoms; bottom, mud. It was found attached to an arm of a *Comatula* or *Pentacrinus*.

Observations.—In the shortness of the carina this species much resembles *Scalpellum brevecarinatum*. However it can be easily distinguished from that species, especially by the form of the carinal latus.

Scalpellum triangulare, n. sp. (Pl. III. figs. 17, 18; Pl. XI. fig. 4).

Valves thirteen; surface of the valves covered by a rather thick chitinous membrane, furnished with short woolly hairs. Carina simply bowed, with the umbo at the apex; boat-shaped, without a flattened roof. Upper latus quadrangular, trapeziform.

Umbo of the carinal latus in the middle of the carinal margin. Peduncle short. Males, one on each side.

Of this small species four specimens were collected together with *Scalpellum parallelogramma*.

The *capitulum* is very thick and robust, especially near the peduncle, growing flatter towards the apex. The margins of the valves and the structure of the surface of the valves cannot be easily made out, as they are covered by a rather thick chitinous membrane, which is woolly, with short hairs at the surface. Valves distinctly striated when the chitin is taken away.

The *scutum* is broad, its breadth being almost two-thirds of its length, convex, quadrilateral, with the occludent margin slightly arched. Tergal margin hollowed out, lateral margin arched, basal margin almost straight. The umbo is at the apex, which projects considerably over the tergum.

The *tergum* is triangular, flat, with the inferior part produced and the occludent margin slightly convex. Its area is a little greater than that of the scutum.

The *carina* is boat-shaped, narrower at the upper than at the lower extremity. Sides only developed at the superior half of the valve, and here semilunar shaped. Striæ much more distinct, and separated by broader interspaces than on the other valves. The lines of growth are oblique. The flattened roof of the carina in most other species is totally wanting in the present species.

The *upper latus* is quadrilateral, or rather, trapeziform, the scutal margin being much longer than the carinal margin; the latter is straight, the former is distinctly hollowed out, with the angles at the upper and under extremities very sharp.

The *rostral latus* is nearly twice as long as broad, widening considerably from the rostral extremity to the opposite end.

The *infra-median latus* is small, triangular, with the umbo at the apex.

The *carinal latus* is large, greater in area than the rostral and infra-median latera together. Basal margin straight, carinal margin very concave in the superior half; the umbo of the carinal latus is placed almost in the middle of the carinal margin; inferior half of the carinal margin very convex. Upper margin straight, lateral margin also straight, making with the upper margin an angle a little greater than 90°.

Length of the capitulum about 9 mm., of the peduncle 3·5 mm.

The *peduncle* is short, with the scales in about seven longitudinal rows covered by the chitinous membrane, each row containing transversely about eight scales.

Mouth.—The *labrum* is angularly bent in the middle, the angle being directed towards the adductor muscle of the scutum. The margin of the labrum is furnished with extremely small teeth. The palpi are triangular and small, with a few hairs only at the extremity. The *mandibles* have three nearly equal and equi-distant teeth; the inferior angle is

bluntly truncated, and bears small and numerous short spines or teeth. The *maxillæ* (Pl. XI. fig. 4) have a simple edge with numerous spines; a very small notch is visible a little behind the middle. The upper spine is large, much larger than the second one. The part above the notch forms a distinct projection over the lower part. *Second maxillæ* only slightly developed, covered almost over its whole surface with numerous slender hairs.

Cirri.—First pair short, with unequal rami; the longest ramus has seven, the shortest five segments. The other cirri in the specimen I have dissected have at least one of the rami truncated, and the truncated extremity swollen in a curious way; it looks almost as if each ramus was furnished at its extremity with a number of globular vesicles.

Caudal appendages rudimentary, of one segment only.

The specimens are attached to a Sclerodermous Zoantharian (*Flabellum?*)

A small complemental male is present at both sides, attached near the occludent margin of the scutum. It has a length of 0·88 mm., and shows a well-developed testis with a receptaculum seminis. At the anterior extremity it is furnished with well-developed antennæ; at the other extremity a circular space is to be distinguished, enclosed by a thickening of the chitinous wall of the body.

Among the eggs, which entirely fill the cavity of the capitulum, I observed a larva in the Cypris-stage. The ova were fecundated, and happened to be in one of the later cleavage-stages.

This species was taken at Station 320, February 14, 1876; lat. 37° 17′ S., long. 53° 52′ W.; depth, 600 fathoms; bottom temperature, 2°·7 C.; bottom, hard ground.

Verruca, Schumacher, 1817.

The genus *Verruca* comprises those Cirripedia which are not furnished with a peduncle, which have scuta and terga without depressor muscles, movable only on one side, on the other side united immovably with the rostrum and carina into an asymmetrical shell.

This genus is the only representative of a whole family of Cirripedia, which, according to Darwin, has affinities equally divided between the two great Families of Balanidæ and Lepadidæ; it differs from all the other genera "in the extraordinary unequal development of the two sides of the shell." Darwin gives a very extensive description of the genus and of the different species known to him. Though the Challenger brought together specimens of six different and new species of this genus, I have not been able to add so much to our knowledge of the genus as I should have wished, except as far as regards its geographical and bathymetrical distribution. All the species are relatively small, and most of them are represented by one or two specimens only.

Darwin describes four recent species of this genus: *Verruca strömia*, O. F. Müller, sp., which inhabits the shores of northern Europe, and which is found fossil also in Glacial deposits of Scotland, &c., &c.; *Verruca laevigata*, G. B. Sowerby, extending from

Tierra del Fuego up the west coast of America to Peru; *Verruca spengleri*, Darwin, from Madeira; and *Verruca nexa*, Darwin, from the West Indies. Besides *Verruca strömia*, O. F. Müller, another fossil species has been discovered since the appearance of Bosquet's Monographie des Crustacés fossiles du Terrain Crétacé du Duché de Limbourg,[1] viz., *Verruca prisca*, Bosquet, which was found also in chalk in Norwich. As far as my knowledge goes, no descriptions of new species have been published since the appearance of Darwin's Monograph. On six different occasions H.M.S. Challenger collected specimens of this genus. They are, no doubt, some of the more interesting forms of animal life collected during the expedition: in the first place, because they show that the number of species of this genus is far greater than it has hitherto been thought; in the second place, because they show that the genus has a true world-wide distribution: of the six Stations which yielded *Verruca*, one belongs to the Northern Atlantic, three to the Southern Atlantic, one to the Pacific, and one to the Malay Archipelago; in the third place, because the range in depth of the genus is greatly extended by them, the depths inhabited by the six Challenger species being respectively 500, 520–630, 1050, 1425, 1525, and 1900 fathoms, whereas the greatest depth from which Darwin knew specimens of *Verruca strömia* to have been taken was only 90 fathoms; in the fourth place, because these new species form together a very distinct and characteristic division of the genus, showing affinity to *Verruca nexa*, as far as regards the perpendicularity of the walls, and the presence of a distinct third articular ridge on the outer surface of the scutum. In the latter respect they come also near to the fossil *Verruca prisca*.

As I pointed out already in the first chapter of this report, in the case of *Verruca*, as well as in that of *Scalpellum*, there is coincidence of great antiquity with the occurrence at a considerable depth. However, as there are also known species inhabiting rather shallow water, there should not be attached too much value to this.

The specimens collected during the cruise of H.M.S. Challenger in some respects closely resemble each other. I will describe them, however, as so many different species, though perhaps future investigations may show that, at least some of them, must be considered as local varieties of one and the same species.

For the determination of the species of this genus I have composed the following table:—

Verruca.

I. Shell much depressed, irregularly circular.
  - I. Under side of the movable scutum with a prominent adductor ridge, *Verruca spengleri*, Darwin.
  - II. Under side of the movable scutum with a slight depression for the adductor muscle.
    - (*a*) Lower articular ridge of the movable scutum not half as broad as the upper articular ridge, ... *Verruca strömia*, O. F. Müller, sp.
    - (*b*) Lower articular ridge broader than the upper articular ridge, . *Verruca laevigata*, G. B. Sowerby.

[1] Bosquet, Monographie des Crustacés fossiles du Terrain Crétacé de Limbourg, 1853.

II. Shell not depressed.
- I. Movable scutum with three prominent longitudinal ridges, . . *Verruca nexa*, Darwin.
- II. Only one prominent longitudinal ridge is developed.
  - (*a*) Longitudinal ridge separated by a broad interspace from the tergal margin.
    - 1. Apex of the movable scutum projecting freely, . . *Verruca sulcata*, n. sp.
    - 2. Apex of the movable scutum not projecting freely, . *Verruca gibbosa*, n. sp.
  - (*b*) Longitudinal ridge separated by a narrow interspace from the tergal margin.
    - 1. Immovable scutum divided into two triangular parts forming an angle together, ... *Verruca nitida*, n. sp.
    - 2. Immovable scutum convex, ... *Verruca quadrangularis*, n. sp.
  - (*c*) Longitudinal ridge close to the tergal margin.
    - 1. Apex of the carina very prominent and sharp, . . *Verruca obliqua*, n. sp.
    - 2. Apex of the carina not very prominent, . . . *Verruca incerta*, n. sp.

Verruca gibbosa, n. sp. (Pl. VI. figs. 17, 18 ; Pl. XI. figs. 5–9 ; Pl. XII. figs. 1–5).

Shell white ; surface smooth, with very prominent growth-ridges and furrows between the articulating ridges ; walls almost perpendicular to the surface of attachment ; base nearly triangular, not very narrow. Movable scutum rather large, with the upper articular ridge hardly distinguishable, and a very prominent third articular ridge, which is separated from the tergal margin by a rather broad interspace ; apex pointed, not projecting freely ; apex of the movable tergum almost pointed. Apex of the carina and rostrum recurved, and projecting freely beyond the surface of the shell. Rostrum and immovable scutum bulky.

This is the largest and the most beautiful of the deep-sea species. It is represented by four well-developed specimens.

The surface of the shell is naked, no trace of a chitinous membrane being visible. The growth-ridges can be distinctly made out on the operculum as well as on the other valves. The surface of the rostrum and the carina, as well as that of the immovable scutum is furnished with single deep furrows, which serve for the articulation of the valves.

The movable scutum and tergum are by no means at right angles with the fixed pair ; they form one of the sides of a triangular pyramid, the two other sides of which are formed by the immovable scutum and tergum. These latter are extremely steep. In most specimens the movable scutum and tergum lie in a flat plane with part of the carina and of the rostrum ; in one of the specimens (that figured Pl. VI. fig. 17) the rostrum is convex beyond that plane. Of the sutures, that between the carina and rostrum is very characteristically toothed ; that between the immovable scutum and immovable tergum is not so obscure as in other species of the genus ; the immovable scutum shows a kind of radius, which slightly projects over the immovable tergum. The carina also is furnished

with a kind of radius, which projects over the immovable tergum. The articulation of the rostrum with the fixed scutum is the least distinct of all.

When the operculum is taken away, the orifice resembles a scalene triangle; one side (the shortest) is formed by the occludent margin of the fixed tergum; the second side partly by the occludent margin of the fixed scutum; the third (the longest) side by the upper margin of carina and rostrum combined.

The *movable scutum* (Pl. XII. figs. 2 and 4) is not very small, its area equalling nearly two-thirds of that of the movable tergum. Its shape is triangular; the tergal and basal margins are about at right angles to each other, and the occludent margin is curved. The length of the basal margin is not quite half the length of the tergal margin. The valve is very thick, especially towards the apex; when investigated from the under side, the surface appears to be bordered by a well-developed rim along the occludent margin. This rim separates a rather deep depression for the adductor muscle from the occludent margin. Towards the sharply pointed apex the rim slightly increases in width. The tergal margin is straight; the upper articular ridge is hardly visible, most probably it is represented by the edge of the valve itself, which forms a furrow with a very short ridge at the under side of the valve near the apex; the second (lower) articular ridge, on the contrary, is well-developed, and is almost parallel to what I propose to consider as a third articular ridge. The latter, which can be also regarded as an axial ridge, runs from the apex to the basi-tergal corner of the valve, is very prominent, grows slightly broader towards the under extremity, and here projects slightly. It corresponds exactly to the third articular ridge of the tergum, which is also considered as such by Darwin. The second articular ridge describes a curve, and has a narrow semi-circular part of the valve between itself and the tergal margin. In this part of the valve the lines of growth are very oblique on the tergal margin of the valve. The part of the valve which is enclosed between the third articular ridge and the occludent margin forms the greatest half of it, and has the ridges of growth in the inferior part parallel to the basal margin; towards the upper extremity the ridges are slightly divergent.

The *movable tergum* (Pl. XII. figs. 1 and 5) is broad and quadrangular. The valve is divided into two triangular parts by the beautifully curved axial or third articular ridge. In that part of the valve which lies between this ridge and the occludent margin, the lines of growth are parallel to the basal margin; in the other half these lines are parallel to the scutal margin. The axial ridge widens downwards and projects very distinctly at the basal point of the valve. The middle articular ridge is close to the axial ridge, and is separated by a somewhat greater distance from the upper, or first articular ridge. Its free edge is formed by the occludent margin of the valve, but it grows broader towards the scutal margin, where it is produced into a slight projection. The occludent margin of the valve consists of two parts, separated by the umbo or apex of the valve,—one beneath the apex (and this part is curved) and the other between this apex and the scutal

margin. The latter part is slightly concave. The apex is bluntly pointed. At the under side the valve shows a distinct rim at both occludent margins; this rim slightly increases in width towards the apex of the valve, where the two meet.

The *fixed scutum* is shorter, but perhaps a little broader towards the base than the fixed tergum. The shape of the valve is triangular, and being very broad and convex at the base, and pointed, slightly beaked at the apex, it resembles half the surface of a conus. The occludent margin is hollowed out for the reception of the corresponding margin of the movable scutum; it forms the free edge of a separate and inflected portion of the valve, which is extremely narrow upwards and distinctly widens downwards. At the tergal margin a kind of radius is visible, which projects over the free edge of the fixed tergum; at the upper half it is extremely narrow and hardly visible, at the under half, on the contrary, it forms a rather broad and triangular portion. The basal margin is very irregularly toothed. The umbo is at the apex; the valve is added to at its inferior extremity. The lines of growth are distinct, but have a very irregular course.

The *fixed tergum* has a very irregular shape; it consists of three portions—a middle and two lateral ones. The middle portion is very narrow at the apex, and increases considerably in width towards the base. It projects very much over the surface of the two lateral parts, hence may be considered as a kind of rim; it is curved, and projects very much beyond the basal margins of the two lateral parts. The valve has two occludent margins which meet at the apex. Of the lateral portions, one is placed between the rim and the immovable scutum, and this is added to in a direction parallel to the scutal margin; it has an irregular triangular shape and a short occludent margin. The other lateral portion is triangular also; it has a longer occludent margin at the edge of a narrow part which is bent forward. Its basal margin is the margin with which it touches the carina; the lines of growth of this valve are parallel to the latter margin. The projecting middle part of the valve probably corresponds to the spur which is so well-developed in most species of *Balanus*. When seen from the under side, the valve consists of two parts, meeting in a line running longitudinally in the middle of the projecting middle portion. These two parts describe together a distinct angle.

Rostrum and *carina* are both triangular in outline. The rostrum is more convex and a little more robust. Both valves have the umbones in their normal places. However, in both they project freely beyond the edge formed by the scutum and tergum. This projecting portion is larger in the carina than in the rostrum; moreover, it is slightly recurved in the former and curved inward in the latter. Both valves are furnished with one very distinct and two rather shallow longitudinal furrows, and where the valves meet each other, it is into these furrows that the well-developed teeth of the other valve penetrate. The lines of growth are rather distinct, and, though not very regular, they are about perpendicular to the direction of these furrows. The number of teeth by which

the two valves are united together is three. The basal margins of these valves are also very irregular. The occludent margin of both valves is furnished with a distinct but narrow ridge.

Basis.—I have not distinctly observed the basal membrane. The interspace left open between the basal edges of the parietes is narrow, and has a very irregular shape.

Body of the animal.—The body is much flattened; yet it does not lie parallel to the surface of attachment, as, according to Darwin, is the case in the other species of the genus. The mouth is flattened, it is not bullate, and it stands at a distance from the adductor scutorum muscle. The *labrum* (Pl. XI. fig. 5) has its crest surmounted by a row of very numerous and small teeth; the palpi are of moderate size, but the tips are very distant from each other. They are not curved, but they bear, as in the species described by Darwin, the bristles only on their outer sides and extremities. The rounded swelling on each side of the labrum to which they are attached is present, as Darwin has indicated. The *mandibles* in this genus, according to Darwin, have three upper main teeth, with two or three minute lower teeth, or (in *Verruca nexa*) with the lower part pectinated with small spines. The present species has the mandibles as in the latter species (Pl. XI. figs. 6 and 6*). The only point to be added is, that in the specimen I have investigated the mandible of the one side was furnished with three, that of the other with four, teeth; an asymmetry to which we must not attach too great importance. The *maxillæ* (Pl. XI. fig. 7) have a very deep notch behind the two upper larger spines; the lower part is rather narrow, and bears some spines, which are not very strong. This lower part forms a step-like projection. The *outer maxillæ* (Pl. XI. fig. 8) are slightly prominent, and not deeply lobed on their inner surfaces. They are clothed with bristles.

Cirri (Pl. XI. fig. 9).—The first pair is relatively stout, and the pedicels especially are well developed. The two rami are equal in length and thickness, and both have thirteen segments. These segments are thickly clothed with spines. The *second pair* has the posterior ramus much longer than the anterior; it is almost twice as long; the number of segments of the short ramus is eight; that of the long ramus thirteen. The two rami of the *third pair* show only a very slight difference in length. The fourth to the sixth pairs have numerous elongated segments, bearing as a rule three pairs of long slender spines in front and two or three slender spines on the dorsal edge of each segment.

Caudal appendages long and slender, and having eleven segments in the specimen I investigated. The *penis* is long and slightly swollen at the extremity.

This species was found attached to the strongly corroded surface of a part of a shell, the nature of which I was unable to ascertain.

The specimen of this species which I dissected contained eggs. These were in a very early stage; their shape was not very elongate, their longest and shortest dimensions being respectively 0·415 and 0·32 mm. The average size of the specimens was 8 mm. in height and 9 mm. distance from the apex of the rostrum to that of the carina.

Four specimens of the species were taken at Station 317, February 8, 1876, lat. 48° 37′ S., long. 55° 17′ W.; depth, 1035 fathoms; bottom temperature, 1°·7 C.; bottom, hard ground.

Observations.—As I said when treating of the genus, the deep-sea *Verrucæ* resemble in some respects *Verruca nexa*, Darwin. However, of the three strongly prominent longitudinal ridges on the scutum of that species, only one (my third articular ridge) is represented in the deep-sea species; moreover, the strongly-ribbed appearance of the whole shell is wanting in the deep-sea species, and finally, the shape of the valves is different. With regard to the parts of the mouth, we find some corresponding features: the shortness of the palpi of the labrum, the presence of the bead-like teeth on the crest of the labrum, the pectinated condition of the lower part of the mandible, &c. The cirri are slightly different as far as the length of the rami, &c., is concerned. As I was not able to investigate the same details in all the deep-sea specimens of different localities, I cannot say whether they all correspond to one another with regard to the structure of the animal's body. There can be no doubt, however, that the deep-sea species, of which the form I called *Verruca gibbosa* has been studied most accurately, are different from those which occur in shallow water, and which were described by Darwin. On the contrary, I am by no means sure that the forms which will hereafter be described as different species must really be considered as such. For whilst I shall give a detailed description of one of the other species (*Verruca quadrangularis*), in the case of the remaining ones I shall only point out the differences which seem to prevent their being described as belonging to one of the other species. Later investigations, made with the aid of a much richer material, will perhaps show that the different deep-sea *Verrucæ* are much more nearly related than I could ascertain.

Verruca nitida, n. sp. (Pl. XII. figs. 6, 7).

Shell white and very flat; surface smooth, with not very prominent growth-ridges. Walls almost perpendicular to the surface of attachment, which being narrow causes the base to be narrow also. Movable scutum relatively large, with a sharply pointed apex; its upper articular ridge can hardly be made out, the third articular ridge, on the contrary, is well developed; interspace between the third articular ridge and the tergal margin narrow. Movable tergum with the apex slightly bowed and blunt. Apex of the carina strongly projecting. The carina articulates with the rostrum by means of a single large tooth, which forms part of the latter valve. Immovable scutum divided into two triangular parts forming an angle with each other.

There is only a single specimen which shows the characters given above. It was taken in the Moluccan Archipelago, and there can be no doubt that it belongs to the

same subdivision of the genus as *Verruca gibbosa*. It is distinct from this species in the first place on account of its greater smoothness; neither the growth-ridges nor the furrows are so distinctly visible as in the former species. The tergum and scutum in general outline much resemble the same valves in *Verruca gibbosa*, but the articular ridges are by no means so distinct. The rostrum and the immovable scutum are not nearly so bullate as in the former species, and the apex of the rostrum is scarcely freely projecting; on the other hand, the carina has the apex very strongly projecting. The most interesting and certainly the most striking point of difference is the way in which the rostrum and the carina articulate together: whereas in *Verruca gibbosa* the rostrum is furnished with three very distinct teeth, which are placed in excavations of the other valve, in *Verruca nitida* only one tooth, which corresponds to the strongest and uppermost one of the other species, can be distinguished; beneath this tooth the two valves unite in a straight line. The immovable tergum and scutum do not form a perfectly flat plane; the apex of both valves is reflected, so that the surface of the valves is slightly concave. The immovable scutum is furnished with a narrow kind of radius, and is divided into two parts, which are placed angularly to each other and meet in a curved line. The apex of the immovable scutum is distinctly beaked, and projects for a considerable way over the immovable tergum. The latter is divided into a middle part and two lateral parts as in the foregoing species.

The only specimen is attached to what may be considered one of the tentacles of a *Pentacrinus*. Its colour is white, its surface is not covered with membrane.

The size of the specimen is 5·5 mm. It was taken at Station 214, February 10, 1875; lat. 4° 33′ N., long. 127° 6′ E.; depth, 500 fathoms; bottom temperature, 5°·3 C.; bottom, Globigerina ooze.

Verruca sulcata, n. sp. (Pl. VI. figs. 19 and 20).

Shell dirty white; flat, especially at the side of the immovable scutum and tergum. Surface with prominent growth-ridges; articular ridges of the scutum and tergum prominent, as are also those of the carina and rostrum. Walls perpendicular to the surface of attachment. Movable scutum rather large, with the apex pointed and projecting freely. Upper articular ridge hardly distinguishable, middle articular ridge penetrates with a sharp tooth between the two ridges of the tergum. Third articular ridge very prominent. The slightly convex rostrum has four teeth, which alternate with three teeth of the carina, and by means of which the valves are united together.

This elegant little form also is represented by a single specimen only. It has the same general appearance as the former species. However, it is not difficult to distinguish it; its scutum is relatively large, and the middle articular ridge terminates below in a very prominent tooth; the third articular ridge is very strongly developed.

The tergum is quadrangular, its apex is not blunt, though not very pointed. The rostrum is distinctly convex, and is furnished with three furrows, which run from the apex to the rostro-carinal margin; this margin shows three excavations separated by teeth. The apex of the valve slightly projects beyond the scutum. The carina has the apex projecting much farther, and is more slender than the rostrum; the furrows on its surface are still deeper than those of the rostrum. The immovable scutum consists of two triangular parts; a large one with a beaked apex, and another one much narrower and forming almost a right angle with the former. A well-developed radius covers a considerable part of the immovable tergum. This consists of a middle portion, which is curved, narrow at the apex, and very broad at the base; a distinct oval portion, which is placed between the middle portion and the immovable scutum; and, finally, a second lateral portion, which is quite on the carinal side of the shell. This latter portion is very narrow at the apex, and does not increase much in width downwards. It can be traced to where it reaches the carina.

In this species the form of the immovable scutum and tergum is no doubt most peculiar; the great flatness of the main portions, together with the almost perpendicular position of the lateral parts, is in none of the other species so striking. The species is also remarkable for the strong development of the furrows and ridges, both on the scutum and tergum and on the rostrum and carina.

The height of the specimen is 5·5 mm., the distance from the apex of the carina to that of the rostrum is not quite 5 mm. The specimen was found attached to what I think is a piece of a Polyzoon. It was taken in the Pacific Ocean; the bottle has the Station number 170; according to the printed list of Stations two dredgings were taken at this Station. I feel unable to decide from which of these the animal was procured, so I give them both.

Station 170, July 14, 1874; lat. 29° 55′ S., long. 178° 14′ W.; depth, 520 fathoms; bottom temperature, 6°·0 C.; bottom, rocks. Lat. 29° 45′ S., long. 178° 11′ W.; depth, 630 fathoms; bottom temperature, 4°·0 C.; bottom, rocks.

Verruca quadrangularis, n. sp. (Pl. XI. figs. 10, 11; Pl. XII. figs. 8–12).

Shell dirty white; surface smooth, with not very prominent growth-ridges. Walls nearly parallel to each other and perpendicular to the surface of attachment. Base elongate oval. Movable scutum relatively large, with the upper articular ridge not distinguishable, and with a very prominent third articular ridge. This ridge is separated from the tergal margin by a narrow interspace. Movable tergum almost regularly rhomboid, with a recurved and blunt apex. Apex of the carina projecting freely; that of the quadrangular rostrum does not project, or only very little. Rostrum and carina articulate together by means of two teeth on each of the two valves.

This species is represented by half a dozen specimens. Unfortunately they suffered from the alcohol having somewhat evaporated. I believe that they can be easily distinguished from the other nearly related species, as well by the form of the scutum and tergum as by that of the immovable valves.

In the *scutum* I did not observe a trace of a first articular ridge. The curve described by the third articular ridge is not, by far, so strongly marked as in *Verruca gibbosa*. Hence the part enclosed between this ridge and the tergal margin is relatively small. The apex is pointed and slightly beaked.

The *tergum* has the apex very blunt; that part of the occludent margin which runs from the apex to the scutal margin is relatively long, and runs nearly parallel to the basal margin. This causes the whole valve to have an almost regular rhomboidal shape.

The *carina* is rather small; its apex as a rule projects freely. Its lateral margin runs almost parallel to the same margin of the rostrum, and so the shell acquires a quadrangular shape.

The *rostrum* is comparatively large, slightly convex, with the basal and upper margins parallel to each other. The two valves articulate together by means of two teeth and two excavations, present as well at the rostral margin of the carina as at the carinal margin of the rostrum.

The *immovable tergum* is much larger than the *immovable scutum*. Both valves are almost regularly triangular and convex. Both have the apices bluntly pointed. The immovable tergum consists of a middle portion and two lateral portions which almost resemble alæ, the immovable scutum has a middle portion also; this is, however, relatively broader; the lateral portions form a series of rays, which are very narrow.

This species lives attached to black coloured horny hollow tubes, which, perhaps, were once inhabited by Annelid worms. The basal edges of the immovable valves are slightly rectangularly inflected, so as to form a ledge round the base. This ledge in the middle of each valve is rather more strongly developed than at both extremities. Hence the margin round the base appears slightly undulating. As this species was represented by numerous specimens, I was enabled to compare also the structure of the animal with that of *Verruca gibbosa*. Though in general a great conformity was observed, there can be no doubt, I believe, that the two species are really different. The following differences can be pointed out as of greater importance.

Mouth.—The *labrum* has the teeth more numerous and also a little more distinct; the *palpi* are slenderer; the hairs on the palpi are not only present at the extremity and on the outer margin, but also on the surface. The *mandibles* (Pl. XI. fig. 10) have three teeth, the third in the outer margin is furnished with notches, and hence looks serrated. The teeth on the inferior angle are not so regular as in *Verruca gibbosa;* they are fewer in number and they present much more strongly marked differences as to their size. The *maxillæ* (Pl. XI. fig. 11) have the notch not so wide as in *Verruca gibbosa;* the spines

along the margin of the notch are a great deal stouter than in the other species. The step-like inferior part is much stouter and broader. The *outer maxillæ* are much less hairy than in *Verruca gibbosa*.

Cirri.—Pedicels of first pair much less developed than in *Verruca gibbosa*. First pair has the rami of equal length, but not of the same number of segments ; the posterior ramus has seven segments, the anterior one has ten ; the length of the third to the fifth segments of the posterior ramus almost corresponds to the length of the third to the eighth segments of the anterior ramus. The second cirrus has also slightly unequal rami ; the shortest ramus has seven, the longest nine, segments. The third cirrus has the rami of equal length, but the number of segments in the two rami is slightly different, being fourteen in the one and fifteen in the other ramus.

Caudal appendages slender, number of segments eight.

Seven specimens of this species were collected at Station 323, February 28, 1876 ; lat. 35° 39′ S., long. 50° 47′ W.; depth, 1900 fathoms ; bottom temperature, 0°·0 C.; bottom, grey mud.

Verruca incerta, n. sp. (Pl. XII. figs. 13, 14).

Shell rose-coloured (?). Surface with prominent growth-ridges, which, however, are not numerous on the rostrum and carina. Walls perpendicular to the surface of attachment. Base narrow, the inferior part of the walls—especially of the rostrum and carina—turned over so as almost to enclose the thread-like spine to which the animal is attached. Movable scutum relatively small ; upper articular ridge not visible, third ridge well developed. That part of the scutum which is placed between the third ridge and the tergum extremely narrow. Apex of the scutum pointed. Movable tergum almost rhomboidal, with a blunt apex, and with the middle ridge almost invisible. Apex of the carina only slightly projecting beyond the surface of the shell.

Of this form I received two specimens mounted in balsam. They are feebly rose-coloured ; whether this is a natural colour or has been artificially produced I cannot say. Inequalities (ridges and furrows) of the surface show the colour more distinctly, and this, as well as the circumstance that the spine to which the specimens are attached is coloured also, would suggest to us that it is not a natural colour. Of the two specimens one is slightly larger than the other ; my definition and description have reference to the larger specimen more especially. The scutum is small, its occludent margin is very strongly arched, its tergal margin is hollowed out, its apex pointed. The occludent margin is slightly reflected outwards, and in this way a kind of ridge along that margin is formed. The tergum is quadrangular, almost completely rhomboid. The lower articular ridge is strongly developed, the upper by no means so distinctly, and the middle ridge is hardly visible.

The margin separating the rostrum and the carina can hardly be made out (in the other, smaller specimen, it is more easily distinguishable). The number of teeth by which the two valves articulate together is only a single distinct one at the rostrum and two at the carina. The apex of the rostrum does not project beyond the surface of the valve, that of the carina only slightly. Both valves, but especially the rostrum, are slightly bulky. The lower extremity describes a kind of bellying beyond the spine to which the animal is attached; at the other side of the spine, the lower edge of the carina and rostrum, being turned over, almost touches the basal margin of the fixed scutum and tergum. The growth-ridges of both valves are very distinct, but they are at considerable distances from each other. The immovable scutum is relatively small; its shape is triangular; it projects with a rather broad radius over the immovable tergum. A considerable part of this valve is to be seen on the side of the movable valves. The apex is bluntly pointed. The immovable tergum is large, bluntly pointed also, and indistinctly divided into a middle and two lateral portions. The immovable tergum has a much greater area than the immovable scutum, and reaches considerably higher upwards than the scutum does.

According to the label of the microscopic preparation, the present species lives attached to the spine of a deep-sea Echinid of the genus *Salenia*. The species was taken in the Southern Atlantic, at Station 335, March 16, 1876; lat. 32° 24′ S., long. 13° 5′ W.; depth, 1425 fathoms; bottom temperature, 2°·3 C.; bottom, Globigerina ooze.

Verruca obliqua, n. sp. (Pl. XII. figs. 15–17).

Shell white; surface with not very prominent growth-ridges. Shell placed obliquely on the surface of the object to which it is attached. Scutum triangular, narrow; the part between the third articular ridge and the tergal margin almost wanting. Tergum with a very blunt apex; quadrangular. Rostrum quadrangular, relatively large, slightly convex; apex in one of the specimens projecting freely, in the others not projecting. Carina with the apex projecting freely and reaching a great deal higher up than the apex of the rostrum does. The carinal margin of the rostrum is furnished with a single tooth, by means of which the valves articulate with one another.

This distinct form is represented by four very small specimens. Their most prominent characteristic is the form of the scutum, which is very narrow; the whole of it represents that part of the scutum in the other deep-sea species which is situated between the third articular ridge and the occludent margin. A second character is furnished by the carina. In all the deep-sea species of the genus *Verruca* this valve has indeed the shape of a keel, but the part which is placed at the side of the movable scutum and tergum is always very large; the other part, at the side of the immovable valves, is

narrow and hardly visible. The line where the two parts meet in other species is slightly concave; in this species, however, it is either straight or even slightly convex. The apex of the carina, moreover, is at a much greater distance from the base in comparison with the apex of the rostrum than is the case in the other species. In most specimens the rostrum and the carina articulate together, as in *Verruca nitida*, by means of a single tooth. The form of the shell, however, comes much nearer to that of *Verruca quadrangularis*.

The fixed scutum and tergum are both elongate. The fixed scutum is triangular, relatively large, and very convex, especially close to the basis. The fixed tergum has a very narrow basal margin, but grows considerably broader towards the middle of the valve. Its apex is like that of the scutum bluntly pointed.

Two of the specimens are attached to small pieces of shell, the two others to small horny tubes, wide at one extremity, and narrow, pointed, and closed at the other. I think these are tubes once inhabited by small Annelids.

This species was taken in the North Atlantic at Station VI., January 30, 1873; lat. 36° 23′ N., long. 11° 18′ W.; depth, 1525 fathoms; bottom temperature, 1°·6 C.; bottom, Globigerina ooze.

Observations.—Together with the four specimens, for which I propose the name *Verruca obliqua*, another representative of the same genus was dredged. In most respects this specimen is different, but especially in the form and relative size of the scutum; it is not only much larger, but it has, moreover, a distinct, freely projecting apex. The tergum much resembles the same valve in most other species of this genus; it is, however, incomplete in the present specimen, its apex being broken off. Rostrum and carina form together a shell, which is broader than that of *Verruca obliqua*, and at the same time is not so high. In this respect it resembles *Verruca nitida*. The immovable tergum and scutum are intermediate between those of *Verruca nitida* and of *Verruca obliqua*. I figure the specimen in Pl. XII. fig. 17. I indicate it as *Verruca obliqua*, var.; I should find it, however, rather difficult to say why it is considered as a variety of this species, and not, *e.g.*, of *Verruca nitida*.

Balanus, Auctorum.

"It is not easy," Darwin says (*loc. cit.*, p. 185), "to exaggerate the difficulty of identifying the species, except by a deliberate examination of the internal and external structure of each individual specimen." If Darwin came to this conclusion, after a study of years, making use of the very rich collections of the British and other museums, and of private collections (in the first place his own, chiefly made during the voyage of the "Beagle"), I need hardly tell how great are the difficulties which I have had to surmount in identifying

the species collected during the cruise of H.M.S. Challenger, as I have neither the long experience of the great monographist, nor the disposal of collections comprising very numerous species.[1] It is true we possess at present all the information laid down by Darwin in his monograph; yet the difficulties with which one has to struggle in determining supposed new species of this genus are very considerable, and may be fairly judged from the curious fact, that in the nearly thirty years which have elapsed since the publication of Darwin's book, only *one* species (*Balanus armatus*, Fritz Müller) has been added to the genus—a genus of which Darwin knew forty-five species—representatives of which may be collected almost everywhere, and on every coast. Many authors, no doubt, have been engaged in investigating species belonging to this genus, and must have met with forms which could not in a very natural way be classed among any of the species described by Darwin. However, as they had not at their disposal a very rich material for comparison, they must have been left in doubt, and hesitated to introduce it into science as a new species. I think, in most cases, these authors have been right in doing so; yet I believe that in some cases the publication of a description, illustrated with good figures, may be useful for the development of our knowledge of the genus and the distribution of its species. Should the identity of any species with one described already before be proved afterwards, as may result from a comparative study of good descriptions and figures, I cannot understand what harm is done to science.

In consequence of the admirable completeness with which Darwin has given in his monograph the descriptions of the species, it has been possible, even easy, to identify with certainty seven of the twelve samples of specimens with species already described. Two of these belong to *Balanus tintinnabulum*, Linn., two to *Balanus trigonus*, Darwin, one to *Balanus lævis*, Bruguière, and two to *Balanus amaryllis*, Darwin. With the five remaining groups this has not been possible. Of these three consist of specimens belonging to species which I have described as new, but which probably are nearly related to species described by Darwin; at least it was possible to rank them with the species of Darwin in the sections into which he proposes to divide the genus. The two other samples of specimens, on the contrary, represent two closely allied but distinct species, which, however, scarcely admit of comparison with species Darwin knew. They form a distinct section of the genus. I was for some time uncertain whether it was not necessary to establish a new genus for their reception. I have not done so, however, because both species come very well within the genus *Balanus*, as characterised by Darwin (compartments six; basis calcareous or membranous; opercular valves sub-triangular). Under *Balanus corolliformis* I will give the characteristics of

[1] Of the forty-five species described by Darwin, I only know the following by my own examination:—*Balanus tintinnabulum*, Linn. (different varieties); *Balanus psittacus*, Molina, sp.; *Balanus trigonus*, Darwin; *Balanus lævis*, Brug.; *Balanus perforatus*, Brug.; *Balanus amphitrite*, Darwin; *Balanus improvisus*, Darwin; *Balanus porcatus*, da Costa; *Balanus crenatus*, Brug.; *Balanus balanoides*, Linn.; *Balanus hameri*, Ascanius; *Balanus amaryllis*, Darwin.

this new section of the genus. I only wish to add here that one of the peculiarities of the new section is that both species are representatives of the deep-water fauna, one being found at a depth of 150 fathoms, the other of even 516 fathoms, and that some of the peculiarities of their structure (of the compartments at least) must be regarded as standing in near relation to their living at so considerable a depth. *Balanus crenatus*, Brug., according to Darwin, lives at a depth down to 50 fathoms; *Balanus porcatus*, da Costa, was dredged during one of the cruises of the Dutch schooner "Willem Barents" (Barents Sea), at a depth of 140 fathoms; the Challenger took another *Balanus* (which I consider as new to science, and for which I propose the name of *Balanus tenuis*) in the Philippine Archipelago, at a depth of 300 fathoms. In this latter species, probably, as well as in the two preceding ones, we have littoral forms in the sense of A. Agassiz,—forms extending from the shore down to 180 fathoms. On the contrary, *Balanus corolliformis* might be considered as a deep-sea species, the upward limit of whose distribution rises as high as 180 fathoms. Of course future dredgings will have to show whether this suggestion is right or wrong.

As the number of species in this genus which I know from personal investigation is small in comparison with those which I have never seen, I have not been able to compose a synopsis for the determination of the species, as was given for the other genera of the group represented in the Challenger collections.

The sections into which the genus is now divided are :—

Section A. Parietes, and basis, and radii permeated by pores. Eight species (no new species).

B. Parietes and basis sometimes permeated by pores, sometimes not; radii not permeated by pores; shell elongated in its rostro-carinal axis; basis boat-shaped, attached to *Gorgoniæ* and *Milleporæ*. Five species (no new ones).

C. Parietes and basis permeated by pores. Radii not permeated by pores. Thirteen species (two new ones, *Balanus armatus*, F. Müller, and *Balanus socialis*, n. sp.).

D. Parietes permeated by pores. Basis and radii not permeated by pores. Five species (one new, *Balanus rostratus*, n. sp.).

E. Basis membranous. Three species (no new ones).

F. Parietes and radii not permeated by pores; basis sometimes permeated by pores, sometimes not, and sometimes excessively thin

and hardly distinguishable. Fifteen species (one new one, *Balanus tenuis*, n. sp.).

G. Parietes not permeated by pores. Radii wanting. Basis membranous. Two species (both new, *Balanus corolliformis*, n. sp., and *Balanus hirsutus*, n. sp.).

Section A. Parietes, and basis, and radii permeated by pores.

Balanus tintinnabulum, Linn. sp. (Pl. XII. figs. 18, 19).

Lepas tintinnabulum, Linnæus, Systema Naturæ, 1767.
Balanus tintinnabulum, Darwin, Balanidæ, 1854, p. 194.

According to Darwin this is one of the most difficult and variable species in the whole genus. Darwin, therefore, distinguishes eleven varieties; he does not consider them as so many different species, because by repeated and very close observation he became convinced that the several points of difference by which each variety is characterised are variable.

The species is represented by two different forms in the collection made during the cruise of the Challenger. I will treat of them separately. The first must be considered as variety (1) *communis*. It is represented by two specimens of very great size; in the largest of the two the base measures 63 × 51 mm., the height 50 mm.; the other is only a little smaller. The surface is totally hidden by a thick layer of calcareous substance; this sticks firmly to the surface; where it is taken away, the bluish-purple colour of the original shell appears.

The shape of the shell is tubulo-conical, the orifice is large, rounded, triangular, very irregularly toothed. Surface longitudinally ribbed; ribs rather strong and flexuous; radii transversely plaited in lines, slightly darker-coloured than the parietes. The sheath is not distinctly coloured and very broad. The strength of the shell is so considerable that it deserves the name of massive.

Scuta and terga with prominent lines of growth. The ribs on the surface of the scuta are finely toothed. The basi-tergal corner of the scutum is very much rounded off. Articular ridge broad and much reflexed; it is very slightly hooked. Adductor ridge not quite confluent with the articular ridge, bounding the cavity for the depressor muscle; it is rather prominent, as Darwin says it generally is in var. *coccopoma* and var. *concinnus*. The cavity for the lateral depressor muscle is deep, as, according to Darwin, is only the case in the two varieties just mentioned, and sometimes in var. *communis*. The surface of the valve is slightly externally depressed in the line of the adductor ridge.

The tergum is broad, the longitudinal furrow is closed. Apex only indistinctly

beaked. Spur placed in the middle of the basal margin. The basal margin, on opposite sides of the spur, does not form a nearly straight line, the scutal portion is about at right angles with the spur; the carinal portion descends nearly as low as the scutal half, but it is hollowed out in the middle, and describes with the spur an angle less than a right angle. The spur is relatively stout; its breadth is exactly one-fourth of the breadth of the valve. The scutal margin is very broadly inflected, the inflected portion forms less than a right angle with the interior surface of the valve. The articular ridge is very prominent and nearly straight; it extends about half-way down the valve. The spur is produced for a considerable distance up the internal surface of the valve as a prominence. The crests for the tergal depressor muscle are well developed. The scuta and terga were calcified together; but they readily became loose after having been boiled in caustic potash.

Judging from the form of the scutum, our specimens might be considered either as var. *coccopoma*, as var. *concinnus*, or as var. *communis*. However, var. *coccopoma* is globulo-conical, with a small rounded orifice, and generally has smooth walls, and this is not the case at all with the specimens under consideration. Var. *concinnus* is also globulo-conical, and has finely ribbed walls. Its scutum, moreover, shows a cavity, bordered by a plate, for the rostral depressor muscle; the cavity is present in the scutum of the Challenger specimens as it is in that of every specimen, but the plate is wanting.

The specimens collected during the cruise of H.M.S. Challenger are from St. Vincent Harbour, Cape Verde Islands. They were taken towards the end of July 1873, at a depth of from 7 to 20 fathoms. The thick calcareous layer that covers both specimens is inhabited by a small Barnacle, belonging to the genus *Chthamalus*, and identical with *Chthamalus dentatus*, Krauss.

The other form, which represents *Balanus tintinnabulum*, Linn., in the Challenger collection, is the variety (6) *spinosus* (Gmelin). This variety has been figured by Darwin, and by means of this figure, as well as his description, it is very easily distinguished; it is globulo-conical or cylindrical; its shell is rather thin, with long, nearly cylindrical, very sharp points directed upwards; colours very pale. The specimens before me are rather flat-conical, and they are not pale, but beautifully purple-coloured; the spines are especially dark. The radii are narrow and pale coloured, with slightly darker transverse lines. The orifices are very small. I tried to prepare the opercula; but, having boiled them with caustic potash, they became so very brittle as not to allow of a trustworthy inspection. The tergum is distinctly beaked, the spur rather long and placed at about its own width from the basi-scutal angle. The adductor and articular ridges of the scutum were partly broken off—so I cannot judge of them as to their distinctness, &c. The specimens are all very small; their base is nearly circular, and has in the largest specimen a diameter of about 7 mm. The height of this specimen is not quite 4 mm.

About six specimens were taken from the screw of H.M.S. Challenger when (April 1876) at St. Vincent, Cape Verde Islands, on her return homewards.

Section C. Parietes and basis permeated by pores. Radii not permeated by pores.

Balanus trigonus, Darwin (Pl. XII. fig. 20).

Balanus trigonus, Darwin, Balanidæ, 1854, p. 223.

This species belongs to the section C of Darwin; its parietes and basis are permeated by pores, its radii are not. The species was met with on two different occasions, and on both only a couple of specimens were obtained, though they are, moreover, incomplete (only one of them being furnished with opercular valves). I have not had the slightest hesitation in considering them as belonging to the above-named species; the ribbed parietes, the mottled purplish-red colour, the broad triangular orifice, are so highly characteristic as not to be easily missed. Had there still remained any doubt, the study of the scutum and tergum of the one specimen would have been sufficient to remove it; the scutum is elongate-triangular, with one distinct longitudinal row of pits; the tergum has no longitudinal furrow, the spur is truncated and very broad; its width is more than one-third of the width of the valve; the spur is situated very close to the basi-scutal angle.

One of the specimens from Port Jackson is not conical and depressed, but rather cylindrical; the shape of its rostrum, moreover, is very interesting, the parietal portion of the valve being strongly curved forward; the tip of the lateral compartment is slightly curved in the same direction. Though this specimen has no opercular valves, it can hardly be doubted, I think, that it belongs to the same species, because of the triangular shape of the orifice, because of its colour and general appearance, and finally, though this is of course not of essential importance, because of its being attached to other specimens of the same species. The ribs on the parietes, however, are not so distinctly developed as in the other specimens. I should not have insisted on this variation of the rostrum if I had not recently had submitted to me for investigation some fossil specimens of a species of *Balanus* from Tertiary deposits of Java which showed exactly the same shape of the rostrum, and in general aspect quite resembled the specimen of *Balanus trigonus* now under my inspection. Most probably *Balanus trigonus* may therefore be suspected of occurring not only in the living condition, but also as a Tertiary fossil.

The specimens collected by H.M.S. Challenger are partly from Port Jackson, Australia, April 1874, depth 6 to 15 fathoms, and partly from Kobe, Japan, May 17 to 19, 1875, depth 8 and 50 fathoms. That the present species lives at a latitude north of 34° is a new fact in its geographical distribution.

Balanus lævis, Bruguière (Pl. VII. figs. 2, 3).

Balanus lævis, Bruguière, Encyclop. Méth. (1789), pl. clxiv. fig. 1.
Balanus lævis, Darwin, Balanidæ, 1854, p. 227.

This species seems to be peculiar to the straits of Magellan; it occurs also at the west coast of South America, and even at the coast of California, but then the species has slightly altered; its shell is not covered with membrane, the orifice is slightly toothed, and it has two furrows on the scutum, whereas the Magellan specimens have only one, Darwin, therefore, considers the form that occurs at the coast of Chili, Peru, and California, a variety.

The Challenger collected numerous specimens, forming together globular masses. They are covered by dirty yellowish-brown membrane, and belong doubtless to the same form which was named by Bruguière, and afterwards elaborately described by Darwin. To his description I do not wish to add anything. I have figured a small globular mass, and a top view of the orifice, which in most specimens is strikingly toothed. The scutum has only one longitudinal furrow.

These specimens were taken in the straits of Magellan, at Station 312, January 13. 1876; lat. 53° 38′ S., long. 70° 56′ W.; depth, 10 to 15 fathoms; bottom, mud.

Balanus socialis, n. sp. (Pl. XIII. figs. 23–28).

Shell not covered by a distinct membrane; orifice relatively large, and not deeply toothed; radii extremely narrow. Tergum with a broad and short spur, and an extremely long basal margin.

In this species the walls as well as the basis are permeated by pores; the radii, however, are not permeated; whence it belongs with the preceding species to the section C of Darwin. It has a tergum of highly characteristic form (Pl. XIII. figs. 25 and 27), and it is represented by a single group of specimens attached to a very curious object, of a nature quite unknown to me. The shape of this object may be judged from fig. 23 on Pl. XIII. Its colour is black as long as it is in alcohol; when dry it is dirty brown coloured. It is hollow; it has a membranous wall within the outer thick wall. It is empty; yet I think I may conclude from the histological structure of the outer wall that it is either a fruit or the stone of a fruit.

About a dozen specimens are attached to one side of this object, which is flat and slightly hollowed out. They are rather small; the greatest diameter of the base of the largest specimen does not measure quite 5 mm.; their height is only half that length. The form of the shell is deep-conical; the orifice is slightly toothed and comparatively large; when closed the opercular valves are nearly horizontal, parallel at least to the surface of

attachment. The surface of the different *compartments* is smooth, but it is covered by a mud-like granular substance, which cannot so easily be taken away, and therefore probably is attached to a very thin and rudimentary membrane. The compartments do not show the growth-ridges very distinctly, but the opercular valves do. The internal surface of the parietes is very strongly ribbed in the lower part.

The *radii* are very narrow, their sutural edges are smooth; their summits very oblique and rounded; the alæ are rather broad, and have the summits not oblique but straight, and parallel to the basis of the shell; the alæ extend only very slightly above the level of the opercular membrane. The parietal tubes are very narrow; in the upper part of the walls they are filled up and solid. The *basis* is very thin, the layers which compose it are extremely thin and fragile; the tubes of the base run radially outwards from the centre to the periphery of the base; the tubes are extremely narrow, and as the base is too thin to permit of a transverse section, the presence of the tubes is always to a certain degree problematic.

The *scutum* is triangular, its occludent margin is slightly toothed, which is caused by the projection of the growth-ridges. The articular ridge is not very prominent, but it extends rather far downwards; the adductor ridge is hardly visible, the pit for the lateral depressor muscle and that for the adductor muscle are both very flat. The *tergum* is well characterised by the length of the basal margin, which surpasses that of the scutal margin; the two parts into which the basal margin is divided by the spur form together a straight line. The spur is short, broad, and bluntly truncated. The carinal margin is arched; the crests for the depressor muscle are very distinct. The articular furrow is not very deep, but distinct. The apex is not at all beaked.

Of the *body of the animal* I cannot give many details. In two specimens I opened I found the body shrivelled, so as to be unfit for close inspection. For want of material I could not sacrifice more. The *mouth* has a *labrum* with three well-developed and sharply-pointed teeth on each side of the notch, and with elongate palpi covered nearly all over the surface with very long hairs. The *mandibles* have only five (four, but one was broken off) blunt teeth, the *maxillæ* have the edge straight, without any notch, and armed with seven broad spines of nearly equal size, the first two being slightly stronger, besides numerous slender hairs. The *second maxillæ* are remarkably elongate. The cirri of the first pair have two very unequal rami.

This species was taken in the Arafura Sea, at Station 188, September 10, 1874; lat. 9° 59′ S., long. 139° 42′ E.; depth, 28 fathoms; bottom, mud.

Observations.—This species has, I believe, not a single near relation among the other species of the section C. On the other hand, I think it resembles much the *Balanus glandula*, Darwin, a species belonging to the section D. In most respects, however, it differs slightly even from this species, and I think, as there can hardly be doubt as to the porosity of its base, it is safest to place it in the section C.

Section D. Parietes permeated by pores. Basis and radii not permeated.

Balanus rostratus, n. sp. (Pl. XIII. figs. 16–22).

Shell white, smooth, not covered by membrane. Carino-lateral compartments very narrow; radii narrow, with their oblique summits rounded. Scutum longitudinally striated; tergum with a broad and blunt spur.

This species has a very characteristic shape, partly caused by its small orifice, partly by the great development of the rostrum and the narrowness of the carino-lateral compartments (Pl XIII. fig. 16). In this respect it resembles *Balanus lævis*, and especially the var. *nitidus*. However, in this species the basis is permeated by pores, and the scutum has longitudinal furrows, which two characteristics are wanting in the present species.

The section D of Darwin contains four species. The first, *Balanus porcatus*, remarkable for the form of its tergum, which has a produced and purple apex; the second, *Balanus patellaris*, with a depressed shell of a brown-violet colour, and an elongate rhomboidal orifice; the third, *Balanus crenatus*, the radii of which are rough and straight, and are furnished with oblique summits and with a scutum without an adductor ridge; the fourth, *Balanus glandula*, with imperfect and small pores in the parietes, which are sometimes in part absent. With none of these does the present species quite correspond, though no doubt it is nearly related to *Balanus glandula*, and also to *Balanus crenatus*.

The shell is conical, white, smooth; neither covered by membrane nor furrowed. The orifice is small and irregularly toothed. *Radii* very narrow, with rounded, oblique summits; the sutural edges of the radii are crenated. The *alæ* are also narrow, they have rounded, oblique summits like the radii. The pores of the parietes are very wide in the lower half of the valves, they are a great deal narrower in the upper half. The *base* is thin; it is finely furrowed in lines radiating from the centre. The sheath extends almost half-way down the valves; the extreme narrowness of the carino-lateral compartments in this species is very remarkable; in this respect the species comes very near to *Balanus quadrivittatus*, Darwin. The rostrum, on the contrary, is very highly developed, and forms a broad, flat valve (Pl. XIII. fig. 17).

The *scutum* (figs. 19, 20) shows very prominent lines of growth, and is distinctly striated longitudinally; the lines of growth are divided into squarish beads by the striæ; the angle formed by the tergal and basal margins is very much truncated. Internally the articular ridge is rather long, but not very prominent; the adductor ridge is distinctly visible, and extends high up on to the superior part of the valve, running almost parallel to the articular ridge; the pit for the adductor muscle is hardly visible; the cavity for the depressor muscle is rather deep. The *tergum* (figs. 18 and 21) shows traces

of longitudinal striæ; the longitudinal furrow is absent or has become closed by the sides being folded inwards. The apex is slightly beaked, the scutal margin is distinctly concave. The spur is broad and blunt, placed at less than its own width from the basi-scutal angle; the hinder side of the spur slopes into that part of the basal margin of the valve which is situated behind the spur. A very distinct articular ridge runs from the apex half way along the valve. The crests for the depressor muscles are hardly visible.

With regard to the structure of the body of the animal, the following details may find a place here.

The *mouth* has a *labrum* with a deep notch, and with three or four extremely small teeth on each side of the notch. The palpi are large, densely covered with not very long hairs. The *mandibles* have five short and blunt teeth, the undermost two of which are rudimentary. The *maxillæ* (Pl. XIII. fig. 22) have the edge straight, with a very small rounded notch behind the two greater spines; at a little distance from the inferior angle there is another large and broad spine, and, moreover, a considerable number of smaller spines between the larger ones. The *second maxillæ* are elongate, densely clothed with hairs on their anterior surface. The first pair of *cirri* has very unequal rami; the shortest has ten, the longest and anterior ramus has twenty segments. The shorter ramus has the segments very protuberant in front, and thickly clothed with spines, which are placed in tufts on the front and the hinder margins of each segment. The other cirri did not show anything very particular.

A group of about ten specimens is attached to a stone; two other specimens are attached to a branch, &c. The size of the specimens is slightly different; the largest specimen has a height of not quite 9 mm., and the greatest diameter of the base is 7 mm.

This species was taken together with specimens of *Balanus trigonus*, and with *Balanus amaryllis*, at Station 233A, May 17 to 19, 1875; lat. 34° 35′ N., long. 135° 10′ E.; depth, 8 and 50 fathoms; bottom mud, sand. Kobe, Japan.

Section F. Parietes and radii not permeated by pores; basis sometimes permeated by pores, sometimes not, and sometimes excessively thin and hardly distinguishable.

Balanus amaryllis, Darwin (Pl. VII. figs. 4, 5).

Balanus amaryllis, Darwin, Balanidæ, 1854, p. 279.

This is, according to Darwin, a distinct and well-defined species. It is characterised by the walls and radii not being permeated by poroes; by its porous basis, by the extremely narrow radii, with their quite smooth, rounded, and very oblique summits. Its scutum is striated longitudinally, its tergum has a very narrow spur. H.M.S. Challenger took specimens of this species on two occasions; once near Station 186, in

Torres Strait, the second time near Hiogo Harbour, Japan. The surface of the shell is beautifully striped with pinkish-purple; the specimens from Kobe, Japan, are darker, almost rose-coloured, and have the shell conical; those of Torres Strait are slightly more cylindrical, and have the orifice larger.

Hitherto the species was only known from the mouth of the Indus, from the East Indian Archipelago, from the Philippine Archipelago, from Moreton Bay (Australia), and from the north-east coast of Australia. So our knowledge of its distribution is slightly augmented by its being observed also in Japan.

Station 186, September 8, 1874; lat. 10° 30′ S., long. 142° 18′ E.; depth, 8 fathoms; bottom, coral sand. Station 233A, May 17 to 19, 1875; lat. 34° 35′ N., long. 135° 10′ E.; depth, 8 and 50 fathoms; bottom, mud and sand. Kobe, Japan.

Balanus tenuis, n. sp. (Pl. XIII. figs. 29–33).

Shell snow-white, glossy; orifice deeply toothed. Radii narrow, with their summits very oblique and slightly concave; basis solid. Scutum striated longitudinally; tergum with a short and rather broad spur.

This species, in many respects, corresponds to *Balanus amaryllis*, Darwin, and especially to the variety (*b*) of Darwin. Yet I think it is different; if we knew something about the origin of this species, we should perhaps consider it as the form which had developed from the other under the changed conditions of the deep sea. Darwin tells us that *Balanus amaryllis* was often met with attached to ships' bottoms, and as the present species was taken from 100 fathoms, we may safely call it a deep-sea species in comparison with the other.

In the collection made during the cruise of H.M.S. Challenger this species is represented by four small specimens only. The greatest diameter of the base of the largest specimen is 7·5 mm. The height of this specimen is not more than 5 mm. The *compartments* are extremely steep; hence the toothed orifice is large. This orifice has the shape of a pentagon. The different compartments are striated longitudinally, caused by the internal longitudinal ribs being visible through the transparent surface, and, though not so distinctly, also transversely. However, the surface is smooth and even glossy. The *radii* are well-developed, though narrow; their upper edges are extremely oblique. The internal surface of the compartments is very strongly ribbed. The *basis* is very thin and shows ribs also, which, however, are solid.

Scuta (figs. 30 and 32) triangular, not elongated, distinctly striated longitudinally. Internally the articular ridge reaches beyond half the tergal margin; it is rather prominent. The adductor ridge is only slightly developed; the cavity for the depressor muscle is narrow.

Terga (figs. 31 and 33) exhibit traces of longitudinal striæ. There is no longitudinal furrow, but, as in *Balanus amaryllis*, the scutal margin is distinctly curved. The valve is slightly beaked. The spur is short and not very narrow; its length equals its distance from the basi-scutal angle. The two parts of the basal margin of the tergum which are separated by the spur describe together an angle little greater than 90°. The crests for the depressors are very distinctly developed.

Mouth.—Labrum with three distinct teeth on each side of the notch. Palpi long, surface covered by numerous slender spines. *Mandibles* with five teeth, the last two of which are small. *Maxillæ* with the edge quite straight, without any step-like projection; the first two are only a little stouter, and before the lower extremity there are again two, which are a little more robust. *Second maxillæ* on their inner faces divided into a large upper and a small inner and lower lobe. The first is almost totally covered with long slender hairs, the second is only slightly hairy.

Cirri.—First pair with very unequal rami; the shortest ramus has the first segment very long, and six following segments short; the longest ramus has the first long segment indistinctly divided into six segments; moreover, it has nine segments following, which are much more slender than are the segments of the shortest ramus. The second cirrus has in both rami ten segments, which are produced on both sides. The pedicels of the second, third, and fourth cirrus are furnished with dorsal tufts of spines. The posterior cirri have segments more broad than long, bearing two pairs of nearly equally long spines, and a third pair, beneath the first two, of very small spines. Between each pair of long spines there is a small intermediate tuft. I have not found out the basi-dorsal point at the penis.

This species was taken at Station 204, November 2, 1874; lat. 12° 43′ N., long. 122° 10′ E.; depth, 100 and 115 fathoms; bottom, mud.

Observations.—This species occurs at the same locality as the nearly related *Balanus amaryllis*, viz., in the Philippine Archipelago.

Section G. Parietes not permeated by pores. Radii wanting. Basis membranous.

Balanus corolliformis, n. sp. (Pl. VI. figs. 21, 22; Pl. XIII. fig. 1–7).

Basis membranous; radii absent; parietes not permeated by pores; tergum with a very broad articular ridge; membrane lining the growth-ridges with distinct spines. Carinal and basal margins of the tergum nearly of the same length.

This is a very remarkable species, and I confess to have been long in doubt whether it was a *Balanus* or not. The investigation of specimens of a nearly related form dredged by H.M.S. "Triton" in the Faröe Channel, which showed the same characteristic differences from the other species of the genus, convinced me that I was right in consider-

ing them as representatives of a new section of the genus *Balanus*. The absence of radii, the solidity of the parietes, the membranous base, form the characteristic marks of this section, which at present comprises only two species. Both species are from rather deep water; and we need hardly doubt that the structure of the shell affords a very striking instance of the influence of their living at a more considerable depth. Being solid (not permeated by pores), the compartments have by no means the strength of other species of the genus, which, as a rule, have the compartments composed of two laminæ united by longitudinal septa; and, moreover, the strength is diminished by the absence of the radii, which in other species, as modified parts of the side of the compartments, overlap the adjoining compartments. In the present species the compartments adhere so feebly as almost to separate on being manipulated. The largest specimen of *Balanus corolliformis* which was obtained, and which, therefore, has been figured (Pl. VI. figs. 21, 22), showed the compartments quite loose from one another, and only adhering by means of the muscles which were attached to them. For an animal living near the surface, the violent beating of the waves would soon prove fatal if its walls showed the structure of our *Balanus corolliformis*. It was taken at a depth of 150 fathoms, at which depth it may be taken for granted that the water does not experience the direct influence of the beating of the waves. The other species was taken at a depth of no less than 516 fathoms.

Balanus corolliformis has to a certain degree the shape of the corolla of a flower, the orifice of the shell being much wider than its base, and being very deeply toothed. The latter character is due to the obliquity of the summits of the alæ, and to some extent also to the circumstance that the alæ are very broad at a certain distance from the base, and then slope downwards, so as to be extremely narrow at the base of the shell. In the largest specimen of this species which was collected, the width of the shell, which is very considerable at the orifice, grows smaller downward, but remains the same almost from the middle to the base. The growth-ridges run regularly nearly parallel in the upper half of the shell, and much more irregularly in the under half. As in some of the cases in which the radii are not developed, mentioned by Darwin, the sutures of the valves in the lower half of the shell at least are marked only by fissure-like lines. The sheath extends one-third down the shell; the rostrum, which, seen from the exterior, does not show a trace of radii, has, when seen from the interior, the sheath divided into three parts, of which the two lateral portions may be considered as rudimentary radii. The rostrolateral compartment and the extremely narrow carino-lateral compartment show also on the inner side traces of what might be considered a radius.

Colour of the shell dirty white; the limits of the growth-ridges are coloured yellowish by the persistence of the membrane, which is distinctly hairy. The hairs are short, stiff, chitinous spines. At different places the surface is irregularly invested by calcareous masses of a Polyzoon. Of the smaller specimens some are attached to the spines of an

Echinid, and these have very narrow bases; the larger specimens, however, have a circular base, and are found attached to stones. The base is very thin, membranous.

The opercular valves are united together, and to the shell by strong membrane of a light yellowish colour. The exterior surface of the valves is totally hidden by a thick hairy chitinous membrane. The shape of the *scutum* (Pl. XIII. figs. 2 and 3) is very peculiar. The growth-ridges are very broad and distinct in the superior half of the valve, they are very narrow and only slightly developed in the inferior half. The valve is distinctly bowed, so that the outer side is concave. The occludent margin is slightly inflected, the basal margin is convex, the tergal margin describes a bow. Internally the articular ridge is well-developed, and there is also a pit marked by a slight ridge for the reception of the lateral depressor muscle. The occludent margin is internally strengthened by a well-developed ridge, which runs along the whole margin, but which is especially developed near the basal margin. The cavity for the adductor muscle is hardly visible. The *tergum* (Pl. XIII. figs. 1 and 4) is also slightly bowed, hence concave at the outer side. The apex is pointed and almost imperceptibly beaked. Its scutal margin is long and straight; it is separated by a narrow ridge from the shallow furrow, which runs almost from the apex down to the extremity of the spur. The occludent margin is convex, and only little shorter than the nearly straight basal margin. The spur is not very distinct, and runs almost to the basi-scutal angle of the valve. Internally the valve is well marked by the very strong development of its articular ridge, which from the apex extends almost to the middle of the scutal margin, and which, when seen from the exterior side, projects very considerably beyond the scutal margin of the valve. The crests for the depressors are not very prominent.

The size of the largest specimen is 45 mm. from the tip of the opercular valves to the base. The distance between the apices of the rostrum and carina is about 29 mm. The greatest diameter of the base is 16 mm.

The structure of the *mouth* is in many respects very remarkable. The edge of the *labrum* (Pl. XIII. fig. 5) is not furnished with teeth, but is bordered by extremely minute hairs. What is much more interesting is that it is not notched at all, whereas Darwin says that it is always notched in this genus. The palpi are robust and very long, with their apices almost touching each other. Their surface is furnished with very numerous curled spines, which are not smooth, but in their turn are furnished with very small hairs. The *mandibles* (fig. 6) have four teeth, and the inferior angle is divided into three very small teeth, the first of which is laterally bordered by some extremely small teeth. The distance between the first two teeth of the mandible is greater than that between the following ones. The *maxillæ* (fig. 7) show a small quadrilateral notch behind the two larger upper spines; the part below the notch is slightly projecting, and is furnished with numerous densely crowded spines of nearly the same size. The pair of lower spines larger than the others, which is present on the maxilla of most other species of *Balanus*,

is wanting in the present species. The *outer maxillæ* have the ordinary shape, their inner faces being rather indistinctly divided into two lobes.

Cirri.—The rami of the first pair are only very slightly unequal; both have fourteen segments, but the anterior ramus is slightly longer, because the segments themselves are a little longer. The breadth of the two rami is nearly equal; the anterior surface of each segment is produced in both rami; the projections bear a tuft of spines on their summit. The rami of the second pair are unequal as far as the number of segments is concerned; this is seventeen in the shortest, and twenty-three in the longest ramus. The segments, and especially the lower ones, are produced; the projections thus formed are crowned by a tuft of spines. The rami of the third cirrus have respectively twenty-five and twenty-eight segments. The lower segments are produced on their anterior surface. The three anterior pairs are much shorter than the three posterior ones; whereas the former three are straight or only slightly bowed, the latter are distinctly curled. The number of the segments is much more considerable, and is in the fourth pair thirty-two and thirty-seven. The number of spines on each segment is two, three, or four pairs, two on the upper, three on the middle, four on the lower segments, small spines being inserted between the larger ones in a not very regular way. The undermost part of the pedicels of the four anterior cirri is much swollen, and projects as a kind of vesicle beyond the surface of the animal's body.

The *penis* is long and only indistinctly hairy; but, whilst it is rather thick near the under extremity, it grows very slender at the other end.

This species lives attached to pebbles and also to the spines of a *Cidaris*. The latter specimens are a great deal smaller than those which were found attached to pebbles. Six specimens were taken, only two of which were of considerable size. *Scalpellum recurvirostrum*, n. sp., was procured with the same haul of the dredge. This was at Station 150, February 2, 1874; lat. 52° 4′ S., long. 71° 22′ E.; depth, 150 fathoms, bottom temperature, 1°·8 C.; bottom, rock.

For the differences between this and next species, *vide* under the same.

Balanus hirsutus, n. sp. (Pl. XIII. figs. 8–15).

Basis membranous; radii absent; parietes not permeated by pores; articular ridge of the tergum broad, but not extending so far downwards as in *Balanus corolliformis*. Carinal margin of the tergum much shorter than the basal margin. Membrane lining the growth-ridges with distinct spines.

Balanus hirsutus and *Balanus corolliformis* are two nearly related species, corresponding in all essential respects. I must consider them, however, as different species, because their shape is quite different, and in the second place, because the tergum shows very striking differences also.

Though also furnished with a deeply toothed orifice, the shape of the shell in this species is much more regularly tent-like than in the foregoing species. It is represented by two specimens only, one of which is attached to the spine of an *Echinus;* this specimen is unsymmetrically flattened, and has an elongate but very narrow base; its orifice is large, which is caused by the perpendicular condition of the compartments; the other specimen is attached laterally to the rostrum and the rostro-lateral compartment of the first; this latter specimen has a very regular shape and a broad circular base, which is large in comparison with the orifice of the shell.

Scutum (figs. 10 and 11) and *tergum* (figs. 9 and 12) resemble very much the same valves of *Balanus corolliformis;* the basal margin of the scutum—especially towards the basi-tergal angle—is much more rounded than in the other species. The tergum is more elongate in the direction from apex to spur; hence the basal is much longer than the carinal margin. The strongly-developed and broad articular ridge does not reach half way to the scutal margin (as in *Balanus corolliformis*), but only reaches along the first third of the scutal margin; the crests for the attachment of the depressor muscle are more distinct than in the other species.

The valves are not covered by a thick woolly membrane, as was the case in the foregoing species; the growth-ridges are bordered by yellow membrane, which is hairy, as in the case of the compartments. The size of the specimens of this species is by no means so considerable as in the foregoing species. The flattened specimen attached to the *Echinus* spine is only 15·5 mm. high; the greatest diameter of the narrow base is only 13·5 mm. The smallest specimen shows a base of 11 mm. diameter, and but a height of 9·5 mm.

The structure of the *mouth* is much like the same part of *Balanus corolliformis.* The *labrum* (fig. 13) does not present differences, except in being much shorter; the *mandibles* (fig. 14) have the fourth teeth very small, and almost forming a part of the step-like process at the inferior angle. The *maxillæ* (fig. 15) are exactly the same; at least one of them, for the two of the same specimen are not quite equal, the one having a much wider notch behind the great upper spines than the other. The *outer maxillæ* present no differences.

The cirri are in all respects formed after the same type as in *Balanus corolliformis;* however, there are little differences in the number of the segments as well as in that of the spines. So the first pair has also two equal rami, which, however, have eleven segments. These details are, however, of no importance, as the specimen, the animal of which I dissected, was the smaller of the two, and probably not quite full-grown.

This species was taken during the cruise of H.M.S. "Triton," at Station No. 10 ("Triton" cruise), August 24, 1882; lat. 59° 40′ N., long. 7° 21′ W.; depth, 516 fathoms; bottom, mud; temperature, 46° to 46°·5.

Observation.—This is the first instance of a species of *Balanus* being taken at so considerable a depth as upwards of 500 fathoms.

Acasta, Leach, 1817.

This genus comprises those sessile Cirripedia which have six compartments, the parietes and basis of which are not porous, and the basis of which is calcareous, cup-formed, not elongated, and attached to sponges, or rarely to the outer layer of the stalk of *Isis*. Darwin describes nine species as belonging to this genus, which are found all over the world. In the Challenger collection I found one of these species represented by a single specimen. It is—

Acasta fenestrata, Darwin.

Acasta fenestrata, Darwin, Balanidæ, 1854, p. 316.

This species differs from the other species of the genus in the large membrane-covered openings between the compartments above the basal cup. The carino-lateral parietes are half as broad as the lateral parietes. The smoothness of the basal edges of the parietes and of the edge of the cup, and the structure of the tergum, with its short and prominent articular ridge and pointed spur, has not been investigated, as I did not wish to sacrifice the only specimen. The form of the deep basal cup downwards ending in a blunt point, slightly curved to one side, answers precisely to the description and figure of Darwin. The only specimen was taken in the Philippine Archipelago.

The specimen is 9 mm. in height, being smaller than those observed by Darwin, the largest of which was 0·6 inches (15 mm.) in height.

Station 208, January 17, 1875; lat. 11° 37′ N., long. 123° 32′ E.; depth 18 fathoms; bottom, mud.

Tetraclita, Schumacher, 1817.

This genus comprises those sessile Cirripedia which have four compartments, sometimes externally calcified together; parietes are permeated by pores, generally forming several rows. The basis is flat, irregular, calcareous, or membranous. The difference between the genus *Balanus* and the present genus consists mainly in the absence of the carino-lateral compartments, and in the numerous rows of parietal pores, *Tetraclita rosea* being the only species with but a single row. As the description Darwin gives of this genus is very elaborate, and as our knowledge has not been considerably augmented since the publication of that description, I think it is of no use to enter into details about it.

The genus comprises eight species, two of which, *Tetraclita rosea*, Krauss, sp., and *Tetraclita coerulescens*, Spengler, sp., are represented in the Challenger collection. For the determination of the species I have composed the following table :—

Tetraclita.

I. Parietes formed by a single row of large tubes, . . *Tetraclita rosea*, Krauss, sp.
II. Parietes formed by numerous rows of tubes.
1. Tergum with the spur joined to the basi-scutal angle.
(*a*) Basis membranous, ... *Tetraclita purpurascens*, Wood, sp.
(*b*) Basis thin, calcareous.
α Radii broad, ... *Tetraclita costata*, Darwin.
β Radii narrow or absent.
(*α*) Surface of the shell corroded, . . *Tetraclita porosa*, Gmelin, sp.
(*β*) Surface of the shell with narrow, serrated ribs, ... *Tetraclita serrata*, Darwin.
2. Tergum with the spur not joined to the basi-scutal angle.
(*a*) Basis thick, calcareous, ... *Tetraclita radiata* (Blainville) Darwin.
(*b*) Basis very thin, articular ridge of the scutum very prominent, ... *Tetraclita coerulescens*, Spengler, sp.
(*c*) Basis very thin, articular ridge of the scutum not very prominent, ... *Tetraclita vitiata*, Darwin.

Tetraclita rosea, Krauss, sp.

Conia rosea, Krauss, Die südafrikanischen Mollusken, 1848.
Tetraclita rosea, Darwin, Balanidæ, 1854, p. 335.

Two specimens of this species were taken in Sydney Harbour (Port Jackson). The two specimens are of a somewhat different size; the larger one measures 31 mm. across the base, a size a little greater than Darwin says it has (1·1 inch). This species was taken from a depth of six fathoms. It must have been very near the surface, for in Australia this species lives attached to littoral rocks and shells.

Tetraclita coerulescens, Spengler, sp. (Pl. XIII. fig. 34).

Lepas coerulescens, Spengler, Skrifter af Selsk., I. 1790.
Tetraclita coerulescens, Darwin, Balanidæ, 1854, p. 342.

H.M.S. Challenger, when at Zamboanga (the most south-western point of Mindanao, Philippines), took some specimens of this species at a depth of 10 fathoms. As there existed differences between these specimens and the description and figures of Darwin, I first thought of describing them as belonging to a different, though nearly related,

species. A close examination, however, brought to light that in most other respects the Zamboanga specimens closely resembled the species as described by Darwin, and so I determined to class them with that species.

General appearance, colour, form of the shell, and structure of the compartments as described by Darwin. Size smaller; the largest specimen Darwin observed was 45 mm. in basal diameter, and the largest specimen from Zamboanga measures only 31 mm. The scutum is much like that described by Darwin, but the tergum has, in the first place, the scutal margin very coarsely toothed; and in the second place, its articular ridge, which, according to Darwin, is not prominent, is very prominent indeed, and therefore resembles much more the same valve in *Tetraclita radiata*. I have figured this valve (Pl. XIII. fig. 34). I almost feel sure that Darwin, had he known the specimens collected at Zamboanga, would have proposed only one species, instead of the two nearly related ones—*Tetraclita coerulescens*, Spengler, sp., and *Tetraclita radiata*, de Blainville, sp. And it is this consideration which has withheld me from describing the Challenger specimens as a third distinct species.

To one of the specimens a *Balanus* was attached, which was still young, and probably belongs to one of the varieties of *Balanus amphitrite*, Darwin. The adductor ridge at the internal side of the scutum, however, was not very distinctly developed.

The specimens of *Tetraclita coerulescens* were taken at Zamboanga, October 23, 1874, from a depth of 10 fathoms.

Coronula, Lamarck, 1802.

This genus comprises those sessile Cirripedia which have six compartments of equal sizes, and thin, deeply folded walls, with the folds forming cavities open only on the under side of the shell; their opercular valves are much smaller than the orifice of the shell.

Of this genus Darwin knew three living species: *Coronula balaenaris*, Gmelin, sp., attached to whales in the Southern Ocean; *Coronula diadema*, Linn., sp., of the Northern Atlantic Ocean; *Coronula reginæ*, Darwin, attached to whales in the Pacific Ocean. They may be distinguished from one another in the following way:—

Coronula.

I. Ribs of the compartments flattened.
  1. Radii very thick, opercular valves four, . . . *Coronula balaenaris*, Gmelin, sp.
  2. Radii thin, terga absent, ... *Coronula reginæ*, Darwin.

II. Ribs of the compartments convex, ... *Coronula diadema*, Linn., sp.

Coronula diadema is the only species which is represented in the collection made during the cruise of H.M.S. Challenger.

Coronula diadema, Linn., sp.

Lepas diadema, Linnæus, Systema Naturæ, 1767.
Coronula diadema, Darwin, Balanidæ, 1854, p. 417.

This is a very common and very characteristic species, for which Darwin gives the following diagnosis :—the shell is crown-shaped, with longitudinal convex ribs, having their edges crenated ; the orifice is hexagonal ; the radii are moderately thick and very broad ; the terga are absent or rudimentary. The Challenger collected a single set of specimens when at Bermuda in April 1873. They are small specimens, the largest of the seven having a diameter of only 24 mm.

With regard to the geographical distribution of this species, Darwin, who knew only four specimens with certain localities attached to them, suspected that it would only occur in the northern seas, *Coronula reginæ* replacing it in the Pacific. I have not been able to find out whether this opinion is universally admitted at present. I believe, however, that it is somewhat erroneous. Darwin himself found in the British Museum a specimen among some shells of Mollusca from New Zealand, but he does not attach much importance to this single instance, as an animal procured from a floating whale in the early part of a voyage might so easily be sent home with specimens subsequently collected in another region. In the Royal Natural History Museum of the Netherlands at Leyden, there is, however, a single specimen of this species labelled " v. Siebold, Japan," and I think that we have no right to doubt the correctness of this label. This specimen is, moreover, very interesting on account of its great size ; its basal diameter is 78 mm., whereas the largest specimen that Darwin saw was only $2\frac{1}{2}$ inches in diameter (63·5 mm.). In 1881, the Dutch schooner " Willem Barents " collected a specimen of this species at Vardö, which has about the same dimensions as the specimen from Japan.

Chthamalus, Ranzani, 1820.

This genus comprises those sessile Cirripedia which have six compartments, a membranous basis, which sometimes (*Chthamalus hembeli*, Conrad, sp.) is calcareous in appearance, owing to the inflected parietes. It is the only genus of the Sub-Family of Chthamalinæ, Darwin, which was instituted for those Balanidæ in which the rostrum has alæ but no radii, in which the rostro-lateral compartments are without alæ on either side, and which have no porous parietes.

All the species of this genus seem to be littoral ; at least Darwin says that this is the case with all the species of whose habits he knows anything, and I do not believe that in this respect our knowledge has been increased since the publication of his monograph. Owing probably to their littoral habits, Darwin does not believe that any species of the genus has hitherto been found fossil. Whether these two facts stand really

in so near a relation to one another as Darwin suggests, I am inclined to doubt; nevertheless it is true that we do not know a single fossil representative of this genus.

What the Challenger collected as representatives of this genus is of no consequence. I have, however, been obliged to describe one of the two species which the collection contained as new to science. According to Darwin this genus comprises eight species; two new species were proposed by Frey and Leuckart for two forms which they considered as different from *Chthamalus stellatus*, and which were found at Heligoland. I think, however, they are only varieties of the true *Chthamalus stellatus* as described by Darwin.

The species of this genus may be determined with the aid of the following table :—

Chthamalus.

I. Scutum and tergum completely calcified together, . . . *Chthamalus intertextus*, Darwin.
II. Scutum and tergum not calcified together.
  i. Tergum with a deep narrow pit for the depressor muscle, . *Chthamalus scabrosus*, Darwin.
  ii. Tergum without a deep pit for the depressor muscle.
    (*a*) Scutum with two or three furrows extending down to the middle of the valve, ... *Chthamalus hembeli*, Conrad, sp.
    (*b*) Scutum without furrows.
      α Tergum with the carinal margin protuberant.
        (i.) Sutures of the walls formed by interlocking teeth. Tergum not elongate, . . *Chthamalus dentatus*, Krauss.
        (ii.) Sutures of the walls not formed by interlocking teeth. Tergum elongate, . . *Chthamalus challengeri*, n. sp.
      β Tergum with the carinal margin not protuberant.
        (i.) Radii with the sutural edges quite smooth, . *Chthamalus antennatus*, Darwin.
        (ii.) Radii with the sutural edges crenated.
          1. Terga triangular, equilateral; orifice of the shell much elongated, . . . *Chthamalus fissus*, Darwin.
          2. Terga not equilateral; orifice not elongated.
            (1) Membrane lining the sheath, and the opercular valves fimbriated, . *Chthamalus cirratus*, Darwin.
            (2) Membrane lining the sheath, and the opercular valves not fimbriated, . *Chthamalus stellatus*, Poli, sp.

Chthamalus dentatus, Krauss.

Chthamalus dentatus, Krauss, Die südafrikanischen Mollusken, 1848.
Chthamalus dentatus, Darwin, Balanidæ, *loc. cit.*, p. 163.

This species has the shell white or brownish, sutures between the valves formed by interlocking teeth; the tergum has a protuberant carinal margin. I refer to it some very small specimens of *Chthamalus*, which are imbedded in the corroded surface of the large specimens of *Balanus tintinnabulum*, taken at St. Vincent Harbour, Cape Verde Islands.

The specimens have irregularly folded walls, with the surface corroded and entirely covered by the calcareous coating of the *Balanus;* they are so totally embedded in this calcareous layer, that their surfaces only appear when the lime is removed. The orifice of the shell, with the indistinctly visible opercular valves, betrays the presence of this Cirriped. The opercular valves also have the surface corroded and disintegrated; having been isolated and cleansed as far as possible (boiled with caustic potash, &c.) it is possible to judge of their form; in general it is much the same as described by Darwin. The tergum not only corresponds to the specimens of Darwin because of the very prominent articular ridge, but also because of the arched and protuberant carinal margin.

This species inhabits the coast of south Africa and Natal, of west Africa, Loanda, and the Gold Coast. The Cape Verde Islands must now be added as a new locality. Darwin saw a specimen from the West Indies, but it was the variety which so commonly adheres to ships' bottoms.

July 1873, 7 to 20 fathoms; St. Vincent Harbour, Cape Verde Islands.

Chthamalus challengeri, n. sp. (Pl. XIII. figs. 35–38).

Shell white, thin, brittle; surface smooth, irregularly folded; sutures between the valves distinct. Tergum with an arched and protuberant carinal margin, elongate in the direction of the spur.

I propose this new name for a species of the genus *Chthamalus* of small size, which was taken from the screw of H.M.S. Challenger. There is a considerable number of specimens, the greater part of which have an irregular cylindrical shape. I think they are all of the same age, and as some of them are furnished with eggs, they are probably quite or at least very nearly full-grown. The cylindrical specimens form, as a rule, groups, being attached to one another by their lateral compartments. The other specimens have a flattened conical shape; they are either isolated or associated in groups; in the latter case, however, they adhere to one another only by the basal edges of their compartments. Often, but most obviously so in the cylindrical specimens, the basal margin is continued into a ledge, which, however, is not inflected inwards but outwards. In the flat-conical specimens the surface of the parietes is almost totally smooth, and in them folds are only visible near the basal margin; hence in these specimens the basal edge is sinuous. The cylindrical specimens distinctly show that they were in the beginning flat-conical, like the other specimens. The cylindrical lower part of the shell is often narrower than the upper part. In these specimens the walls are almost flat in the lower half, but irregularly folded in the upper half. The radii in all the specimens are very narrow, their sutural edges are not at all crenated; the alæ are broad, their upper edges are only slightly oblique. In all the specimens the sutures are distinctly visible.

The *scuta* (Pl. XIII. fig. 37) are triangular, but the tergal margin is much shorter than the other margins; the depression for the adductor muscle is not very deep, but the articular ridge is very prominent and has an arched edge. The *terga* (Pl. XIII. fig. 38) are elongate, rather narrow. The spur is not very distinctly developed. The crests for the depressor muscles cannot be said to descend beneath the basal margin of the valve. The articular ridge is strongly sinuous, but it is also very prominent. The carinal margin is distinctly arched.

Of the animal itself I will only give details with regard to the structure of the mouth and the first two cirri. The crest of the *labrum* is not only hairy, but there are also some fine teeth. The *palpi* are very broad and stout, and bear a great number of hairs, which are placed along both margins, and also on the exterior surface; the hairs are different in length, but they have almost the same thickness. The *mandibles* have three normal teeth; the fourth is divided into two parts, and is situated immediately in front of the pectinated inferior angle. At the inferior extremity of this angle a slightly stronger tooth is visible. The *maxillæ* have three larger spines above the notch and three smaller ones on the upper margin of the notch. Behind the notch a row of spines is visible, the posterior ones being smaller than the anterior. The *second maxillæ* show a terminal lobe and a lower lobe, both furnished with numerous spines. The *first pair* of *cirri* has six segments in both rami; the *second pair* six segments in the one and eight in the other ramus; both cirri have the front margin of the rami covered with numerous spines, the hinder margin being furnished with tufts of spines at the extremity of the segments.

This species was taken in the Pacific, September 2, 1875, from the screw of H.M.S. Challenger. (About Station 269, lat. 5° 54′ N., long. 147° 2′ W.) The Challenger left Yeddo (Japan) about the middle of June, after a stay of more than a month in the waters of Japan. Probably the specimens attached themselves in the Cypris-stage to the screw when the vessel was there.

This species is no doubt nearly related to *Chthamalus stellatus*, Poli, sp., and also to *Chthamalus antennatus*, Darwin. The difference is, I think, in the form of the opercular valves, which in the two above-named species, according to Darwin, are hardly distinguishable from one another. In the present species the articular ridge of the scutum is much more prominent, and besides, the form of the tergum is much more elongate. On account of its carinal margin being protuberant, it resembles *Chthamalus dentatus*, Krauss, but in consequence of the slightly-pointed and depending basi-carinal angle it is perhaps also related to *Chthamalus cirratus*, Darwin. Many of the so-called species of this genus resemble one another so much that one almost feels inclined to doubt the correctness of Darwin's opinion when he considers them as so many different species. It is, however, possible that a close examination of the groups of specimens which Darwin had at his disposal would convince us, on the other hand, that the great naturalist was right in the present case also.

INDEX.

The figures in dark type indicate the pages on which the species are fully described.

Acasta, 160.
cyathus, 30.
fenestrata, 34, **160.**
glans, 33.
lævigata, 34.
purpurata, 34.
spongites, 5, 30.
sporillus, 34.
sulcata, 32.
Alcippe lampas, 3, 29.
Alepas, 56.
cornuta, 29, 56, 57, 58, 59.
minuta, 5, 28, 56, 58.
parasitica, 5, 28, 56.
pedunculata, 32, **57.**
tubulosa, 7, 32, 56, 59.
Anelasma squalicola, 4, 13, 18.
Balanus, 144.
ajax, 34.
allium, 32.
amaryllis, 10, 32, 34, 35, 145, **153**, 154, 155.
amphitrite, 5, 6, 10, 29, 30, 32, 34, 35, 145, 162.
armatus, 6, 31, 145, 146.
balanoides, 4, 5, 6, 29, 145.
calceolus, 29.
capensis, 30.
cariosus, 36.
cepa, 35.
concavus, 32, 34, 36.
corolliformis, 32, 145, 146, 147, **155**, 158, 159.
crenatus, 4, 6, 10, 11, 29, 30, 145, 146, 152.
cymbiformis, 34.
declivis, 5, 30.
decorus, 32.
Balanus eburneus, 6, 29.
flosculus, 36.
galeatus, 29.
glandula, 36, 151, 152.
hameri, 10, 30, 145.
hirsutus, 30, 147, **158.**
humilis, 9.
imperator, 32.
improvisus, 4, 5, 6, 29, 31, 36, 145.
lævis, 31, 36, 145, **150**, 152.
navicula, 34.
nigrescens, 32.
nubilus, 36.
patellaris, 34, 152.
peregrinus, 9.
perforatus, 5, 29, 30, 145.
pœcilus, 36.
porcatus, 3, 4, 10, 29, 35, 145, 146, 152.
psittacus, 31, 36, 145.
quadrivittatus, 34, 152.
rostratus, 35, 146, **152.**
socialis, 34, 146, **150.**
spongicola, 29, 30.
stultus, 29, 34.
tenuis, 34, 146, 147, **154.**
tintinnabulum, 5, 7, 10, 12, 29, 30, 31, 32, 34, 35, 36, 145, **147**, 164.
trigonus, 32, 34, 35, 36, 145, **149**, 153.
tulipiformis, 29.
vestitus, 32.
vinaceus, 36.
Bathymetrical Distribution, 21.
Catophragmus imbricatus, 30.
polymerus, 33.
Chamæsipho columna, 33.
scutelliformis, 36,

Chthamalus, 163.
antennatus, 33, 166.
challengeri, 35, **165**.
cirratus, 7, 36, 166.
dentatus, 30, **164**, 166.
fissus, 36.
hembeli, 36, 163.
intertextus, 35.
scabrosus, 31, 36.
stellatus, 4, 5, 30, 31, 35, 36, 164, 166.
Conchoderma, 53, 55.
auritum, 5, 6, 7, 53, 54, 55.
coronularium, 53, 54.
gracile, 5, 53.
hunteri, 53, 56.
virgatum, 4, 5, 6, 7, 53, **55**.
Conia rosea, 161.
Coronula, 162.
balaenaris, 5, 7, 162.
biscayensis, 5.
diadema, 6, 7, 162, **163**.
reginæ, 7, 162, 163.
Creusia spinulosa, 30, 35.
Cryptolepas rhachianectis, 7.
Cryptophialus minutus, 36.
Dichelaspis, 47.
aymonini, 7, 35, 48.
darwinii, 5, 28, 47, 48, 54.
lowei, 28, 48, 50.
neptuni, 32, 47.
orthogonia, 48, 50.
sessilis, 28, **48**.
warwickii, 33, 35, 50.
Distribution, Geographical and Bathymetrical, 21.
Elminius kingii, 31, 36.
modestus, 33.
plicatus, 33.
rugosus, 6, 33.
simplex, 33.
sinuatus, 6, 33.
Geographical Distribution, 21.
Ibla cumingii, 33.
quadrivalvis, 32.
Kochlorine bihamata, 6, 30.
hamata, 5, 29.
Laura gerardiæ, 18.
Lepas, 37.
anatifera, 4, 5, 6, 7, 8, **38**, 40, 42.
anserifera, 4, 6, 7, 38, **39**.
australis, 37, 41.
Lepas cærulescens, 161.
diadema, 163.
fascicularis, 4, 6, 7, **41**, 43.
hillii, 4, **38**.
pectinata, 5, 6, **40**.
tintinnabulum, 147.
virgata, 55.
Lithotrya cauta, 32.
dorsalis, 29.
nicobarica, 34.
truncata, 34, 35.
Loricula syriaca, 10.
Megalasma, 50.
striatum, 33, **51**.
Octomeris angulosa, 30.
brunnea, 35.
Ornitholepas australis, 7.
Otion stimpsoni, 7, 54.
Oxynaspis celata, 29.
Pachylasma aurantiacum, 33.
giganteum, 30.
Paradolepas neptuni, 6, 47.
Pentalasmis hillii, 38.
Platylepas decorata, 8.
Plumulites newberryi, 11.
Pœcilasma, 43.
aurantium, 28, 44.
carinatum, 28, 31, **44**, 50, 52.
crassum, 28, 44.
eburneum, 3, 33, 44.
fissum, 33, 44.
gracile, 32, 46.
kaempferi, 35, 44, 45, 46.
Pollicipes.
cancellatus, 10.
concinnus, 8.
cornucopia, 5, 29.
darwinii, 6, 32.
elegans, 36.
mitella, 7, 34, 35.
ooliticus, 8.
polymerus, 35, 36.
sertus, 32.
spinosus, 32.
Proteolepas bivincta, 29.
Pyrgoma anglicum, 5, 30.
cancellatum, 30.
crenatum, 35.
grande, 34.
milleporæ, 34.

Pyrgoma monticulariæ, 35.
stokesii, 30.
Scalpellum, 59.
abyssicola, 35, **114**.
acutum, 29, 32, **80**.
africanum, 31, **87**.
album, 33, **85**.
angustum, 3, 29, 91.
antarcticum, 31, **95**, 119.
australicum, 33, 116, **118**.
balanoides, 34, 82, **129**.
brevecarinatum, 31, **82**, 126, 127, 130.
carinatum, 31, 63, 67, **76**, 102.
compressum, 34, 69, **79**, 85.
cornutum, 3, 29, 91, 123.
darwinii, 36, 96, 100, 102, 103, 105, **110**, 124.
depressum, 10.
distinctum, 34, 62, **111**, 118.
dubium, 33, 118, **125**.
elongatum, 31, 32, **93**, 102.
eximium, 31, 98, **100**.
flavum, 31, 113, 114, 124, 125, **127**.
gigas, 35, 96, 100, **102**.
hamatum, 3, 29.
hirsutum, 34, **88**.
indicum, 34, **121**.
insigne, 29, 66, **68**.
intermedium, 32, **70**, 78, 123.
japonicum, 35, 66, **67**, 68, 76, 77.
magnum, 63.
marginatum, 34, **65**, 69, 70.
maximum, 62.
minutum, 36, **113**.
moluccanum, 34, **104**, 106.
novæ-zelandiæ, 32, 113, 114, **124**, 127, 128.
nymphocola, 29, **89**.
ornatum, 30.
ovatum, 34, **69**.
parallelogramma, 31, **83**, 131.
pedunculatum, 32, 96, **99**.
peronii, 32, 99, 124.
planum, 31, 62, **116**.
recurvirostrum, 31, 76, **77**, 158.
Scalpellum regium, 29, 60, 96, 100, 104, 105, **106**, 111, 122, 124, 126.
robustum, 76, 96.
rostratum, 81.
rubrum, 33, **91**.
rutilum, 63, 77.
striolatum, 3, 29, 91.
stroemii, 3, 24, 29, 60, 63, **73**, 90, 98, 122.
tenue, 24, 31, **119**.
triangulare, 31, 126, **130**.
trispinosum, 33, 63, **72**.
tritonis, 29, **122**.
truncatum, 33, **92**, 116, 118.
velutinum, 29, 31, **96**, 98, 99, 100, 104, 105, 126.
villosum, 33, 63, 72, 73, 124.
vitreum, 35, **115**.
vulgare, 3, 5, 29, 62, 68, 74, 76, 77.
Tetraclita, 160.
cœrulescens, 34, 35, **161**.
costata, 34.
porosa, 5, 7, 8, 30, 31, 33, 34, 35, 36.
purpurescens, 33, 35.
radiata, 30, 33, 162.
rosea, 30, 32, 33, 160, **161**.
serrata, 30, 32.
vitiata, 33, 34.
Tubicinella trachealis, 7.
Verruca, 132.
gibbosa, 31, **134**, 139, 141, 142.
incerta, 31, **142**.
lævigata, 31, 36, 132.
nexa, 30, 133, 138.
nitida, 35, **138**, 144.
obliqua, 30, **143**.
prisca, 8, 133.
quadrangularis, 31, **140**, 144.
spengleri, 30, 133.
strömia, 3, 4, 5, 30, 132, 133.
sulcata, 33, **139**.
Xenobalanus globicipitis, 7.
strictus, 7.
Zoocapsa dolichorhamphia, 9.

PLATE I.

PLATE I.

Figs. 1, 2. *Lepas anatifera*, Linn.

Fig. 1. Body, with the left hand scutum and tergum taken away; natural size. *sc.*, right hand scutum; *t.*, right hand tergum; *ca.*, carina; *x.*, membrane; *ma.*, part of the membrane which has been attached to left hand scutum; *m.*, parts of the mouth; c^1, first cirrus.

Fig. 2. Mouth and first cirrus of the left side; magnified 5 diameters. *ma.*, *m.*, c^1 as in fig. 1; f^1 and f^2, filamentary appendages; *p.*, penis; *ovd.*, oviduct; *ga.*, female genital aperture.

Fig. 3. *Lepas hillii*, Leach, sp.

Fig. 3. Mouth and basal articulations of the first three cirri; magnified 6 diameters. *m.*, mouth; f^1, f^2, and f^3, filamentary appendages; c^1, c^2, and c^3, first, second, and third cirrus.

Fig. 4. *Lepas anserifera*, Linn.

Fig. 4. Basal articulation of the first cirrus; magnified 6 diameters. f^1, f^2, f^3, and f^4, filamentary appendages.

Figs. 5–7. *Lepas fascicularis*, Ellis and Sol.

Fig. 5. Mandible; magnified 41 diameters.

Fig. 6. Maxilla; magnified 41 diameters.

Fig. 7. Basal articulation of the first cirrus; magnified 6 diameters. f^1, f^2, f^3, f^4, and f^5, filamentary appendages.

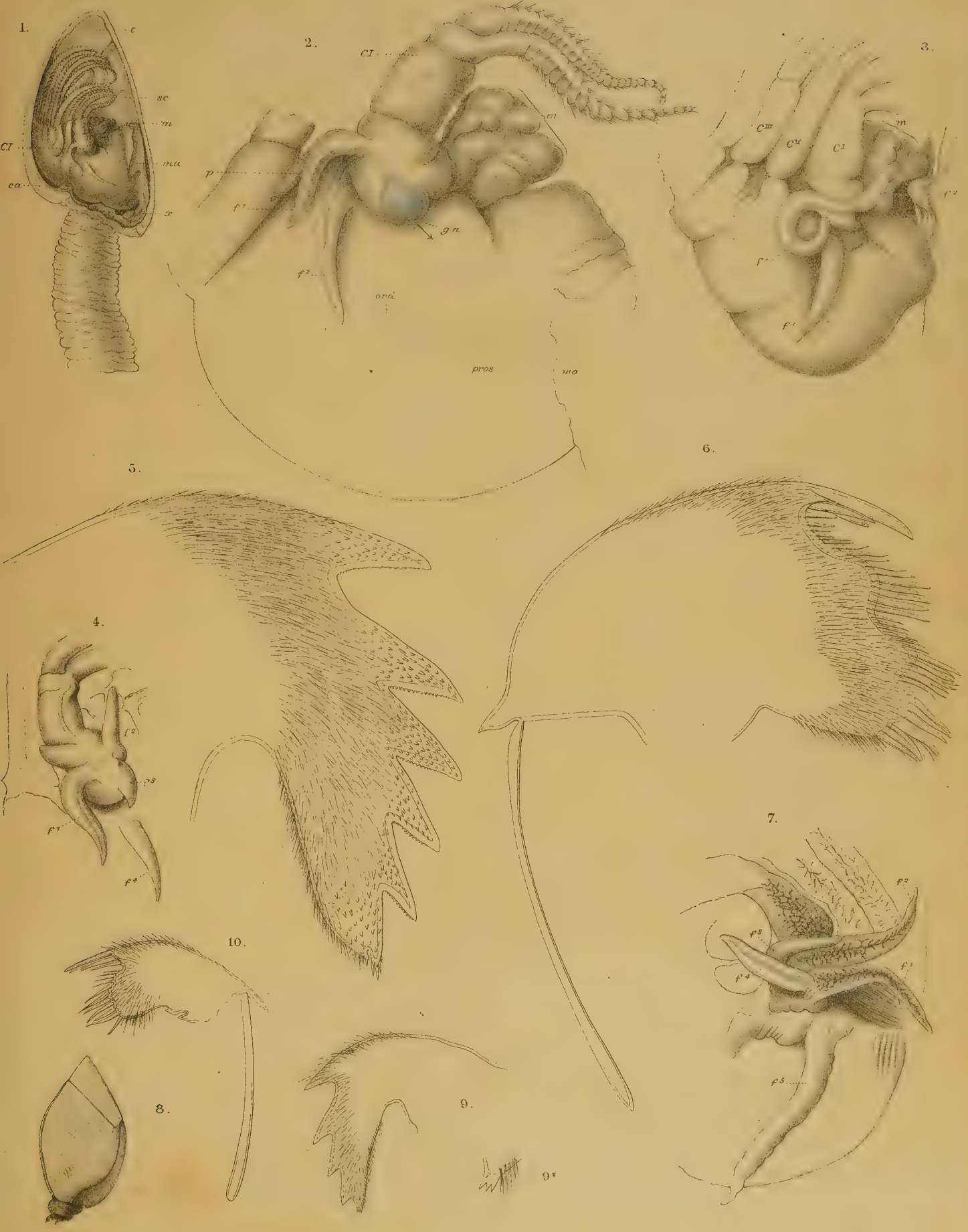
Figs. 8–10. *Pœcilasma carinatum*, n. sp.

Fig. 8. Animal, lateral view; magnified 2 diameters.

Fig. 9. Mandible; magnified 41 diameters.

Fig. 9*. Inferior angle of the mandible; magnified 270 diameters.

Fig. 10. Maxilla; magnified 41 diameters.



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1-2 LEPAS ANATIFERA. 3 L. HILLII. 4 L. ANSERIFERA. 5-7 L. FASCICULARIS.

8-10 BOECHLASMA CARINATA n. sp.

PLATE II.

PLATE II.

Fig. 1. *Pœcilasma carinatum*, n. sp.

Fig. 1. Body taken out of the shell, with an egg-mass; magnified 6 diameters.

Figs. 2–4. *Pœcilasma gracile*, n. sp.

Fig. 2. Animal, lateral view; magnified 6½ diameters.
Fig. 3. Labrum (*la.*), with palpi (*pa.*); magnified 94 diameters.
Fig. 4. Mandible; magnified 94 diameters.
Fig. 4*. Inferior angle of the mandible; magnified 270 diameters.

Figs. 5–9. *Megalasma striatum*, n. gen., n. sp.

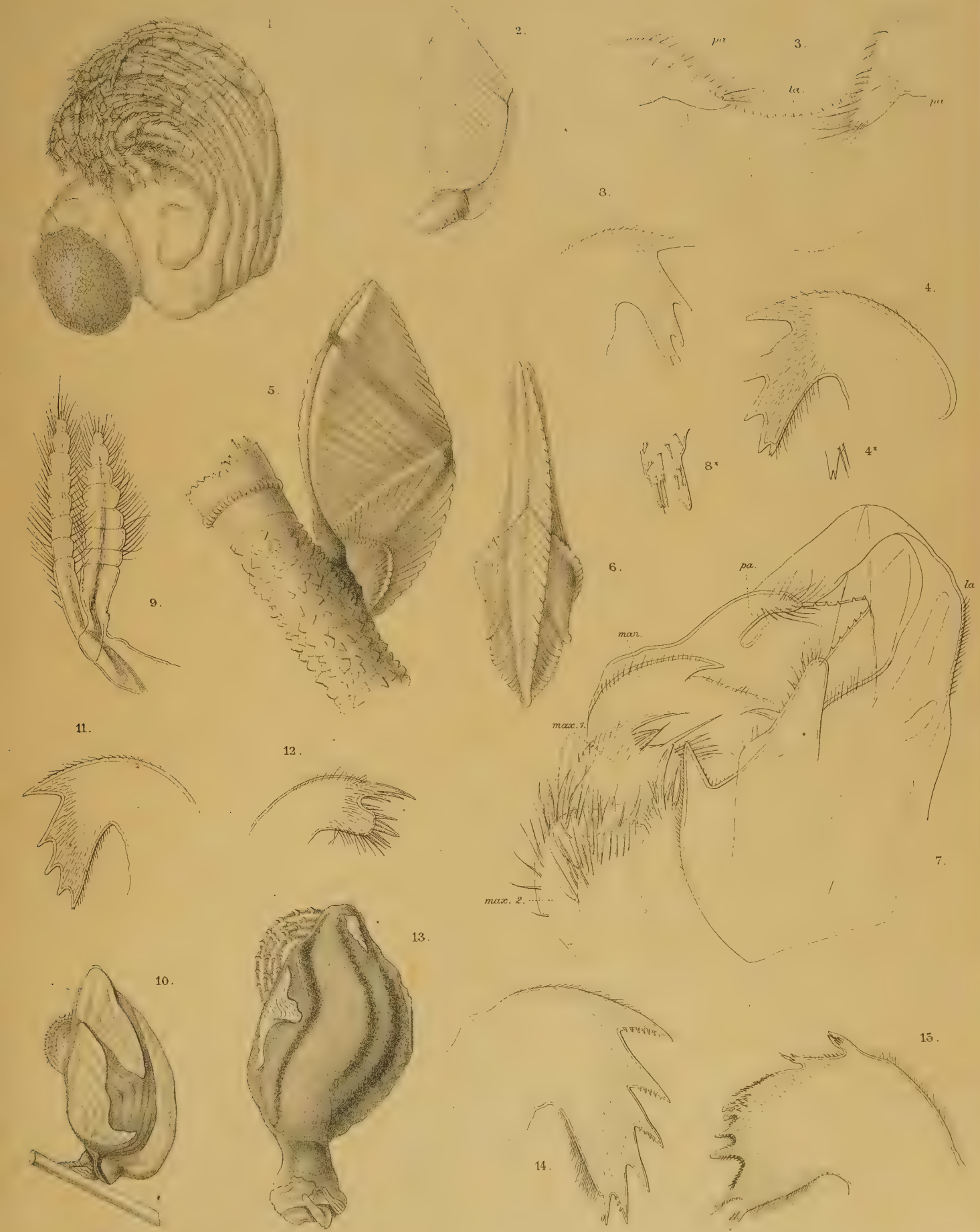
Fig. 5. Animal, lateral view; magnified 6½ diameters.
Fig. 6. Animal, seen from the carinal side; magnified 6½ diameters.
Fig. 7. Mouth; magnified 94 diameters. *la.*, labrum; *pa.*, palpi; *man.*, mandible; *max*^{1}., first maxilla; *max*^{2}., second maxilla.
Fig. 8. Mandible; magnified 63 diameters.
Fig. 8*. Inferior angle of the mandible; magnified 200 diameters.
Fig. 9. First cirrus; magnified 28 diameters.

Figs. 10–12. *Dichelaspis sessilis*, n. sp.

Fig. 10. Animal, lateral view; magnified 6½ diameters.
Fig. 11. Mandible; magnified 63 diameters.
Fig. 12. Maxilla ; magnified 63 diameters.

Figs. 13–15. *Conchoderma virgatum*, var. *chelonophilus*, Leach.

Fig. 13. Animal, lateral view; magnified 5 diameters.
Fig. 14. Left hand mandible; magnified 41 diameters.
Fig. 15. Right hand mandible of the same animal; magnified 41 diameters.



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1 POECILASMA CARINATA, n. sp. 2-4 P. GRACILIS, n. sp. 5-9 MEGALASMA STRIATA, n. gen., n. sp.
10-12 DICHELASPIS SESSILIS, n. sp. 13-15 CONCHODERMA VIRGATA, var. CHELONOPHILUS, Leach.

PLATE III.

PLATE III.

Figs. 1–5. *Alepas pedunculata*, n. sp.

Fig. 1. Animal, lateral view; magnified 2 diameters.
Fig. 2. Mandible, magnified 63 diameters.
Fig. 3. Maxilla; magnified 63 diameters.
Fig. 4. First cirrus; magnified 13 diameters.
Fig. 5. Sixth cirrus, caudal appendage, and penis; magnified 13 diameters.

Fig. 6. *Scalpellum stroemii*, Sars.

Fig. 6. Animal, lateral view; magnified 5 diameters.

Figs. 7, 8. *Scalpellum carinatum*, n. sp.

Fig. 7. Animal, lateral view; magnified 2 diameters.
Fig. 8. Animal, seen from the carinal side; magnified 2 diameters.

Figs. 9, 10. *Scalpellum japonicum*, n. sp.

Fig. 9. Animal, lateral view; magnified 2 diameters.
Fig. 10. Animal, seen from the carinal side; magnified 2 diameters.

Figs. 11, 12. *Scalpellum recurvirostrum*, n. sp.

Fig. 11. Animal, lateral view; magnified 2 diameters.
Fig. 12. Animal, seen from the carinal side; magnified 2 diameters.

Figs. 13, 14. *Scalpellum compressum*, n. sp.

Fig. 13. Animal, lateral view; natural size.
Fig. 14. Animal, seen from the carinal side; natural size.

Figs. 15, 16. *Scalpellum parallelogramma*, n. sp.

Fig. 15. Animal, lateral view; magnified 2 diameters
Fig. 16. Animal, seen from the carinal side; magnified 2 diameters.

Figs. 17, 18. *Scalpellum triangulare*, n. sp.

Fig. 17. Animal, lateral view; magnified 3 diameters.
Fig. 18. Animal, seen from the carinal side; magnified 3 diameters.

Fig. 19. *Scalpellum acutum*, n. sp.

Fig. 19. Animal, lateral view; magnified $6\frac{1}{2}$ diameters.

Figs. 20, 21. *Scalpellum album*, n. sp.

Fig. 20. Animal, lateral view; magnified 2 diameters.
Fig. 21. Animal, seen from the carinal side; magnified 2 diameters.

Fig. 22. *Scalpellum brevecarinatum*, n. sp.

Fig. 22. Animal, lateral view; magnified $6\frac{1}{2}$ diameters.

Fig. 23. *Scalpellum nymphocola*, n. sp.

Fig. 23. Animal, lateral view; magnified 3 diameters.

Fig. 1-6, 19 & 22 P.P.C. Hoek Cet. A.G. Dreschler Del. P.W.M. Trap Impr. A.J. Wandel. Lithogr.

1-5 ALEPAS PEDUNCULATA, n. sp. 6 SCALPELLUM STRÖMII, Sars. 7-8 SC. CARINATUM, n. sp. 9-10 SC. JAPONICUM, n. sp.
11-12 SC. RECURVIROSTRUM, n. sp. 13-14 SC. COMPRESSUM, n. sp. 15-16 SC. PARALLELOGRAMMA, n. sp. 17-18 SC. TRIANGULARE, n. sp.
19 SC. ACUTUM, n. sp. 20-21 SC. ALBUM, n. sp. 22 SC. BREVECARINATUM, n. sp. 23 SC. NYMPHOCOLA, n. sp.

PLATE IV.

PLATE IV.

Figs. 1, 2. *Scalpellum gigas*, n. sp.

Fig. 1. Animal, lateral view; natural size.
Fig. 2. Animal, seen from the carinal side; natural size.

Figs. 3–5. *Scalpellum regium* (Wyv. Thoms.) n. sp.

Fig. 3. Young animal, lateral view; natural size.
Fig. 4. Full grown animal, lateral view; natural size.
Fig. 5. Full grown animal, seen from the carinal size; natural size.

Figs. 6, 7. *Scalpellum eximium*, n. sp.

Fig. 6 Animal, lateral view; natural size.
Fig. 7. Animal, seen from the carinal side; natural size.

Figs. 8, 9. *Scalpellum elongatum*, n. sp.

Fig. 8. Animal, lateral view; natural size.
Fig. 9. Animal, seen from the carinal side; natural size

Figs. 10, 11. *Scalpellum velutinum*, n. sp.

Fig. 10. Animal, lateral view; natural size.
Fig. 11. Animal, seen from the carinal side; natural size.

Figs. 12, 13. *Scalpellum planum*, n. sp.

Fig. 12. Animal, lateral view; magnified 2 diameters.
Fig. 13. Animal, seen from the carinal side; magnified 2 diameters.

Figs. 14, 15. *Scalpellum dubium*, n. sp.

Fig. 14. Animal, lateral view; magnified 2 diameters.
Fig. 15. Animal, seen from the carinal side; magnified 2 diameters

Figs. 16, 17. *Scalpellum antarcticum*, n. sp.

Fig. 16. Animal, lateral view; natural size.
Fig. 17. Animal, seen from the carinal side; natural size.

Fig. 18. *Scalpellum rubrum*, n. sp.

Fig. 18. Animal, lateral view; magnified $6\frac{1}{2}$ diameters.

Fig. 19. *Scalpellum hirsutum*, n. sp.

Fig. 19. Animal, lateral view; magnified $6\frac{1}{2}$ diameters.

Figs. 20, 21. *Scalpellum tenue*, n. sp.

Fig. 20. Animal, lateral view; magnified 2 diameters.
Fig. 21. Animal, seen from the carinal side; magnified 2 diameters

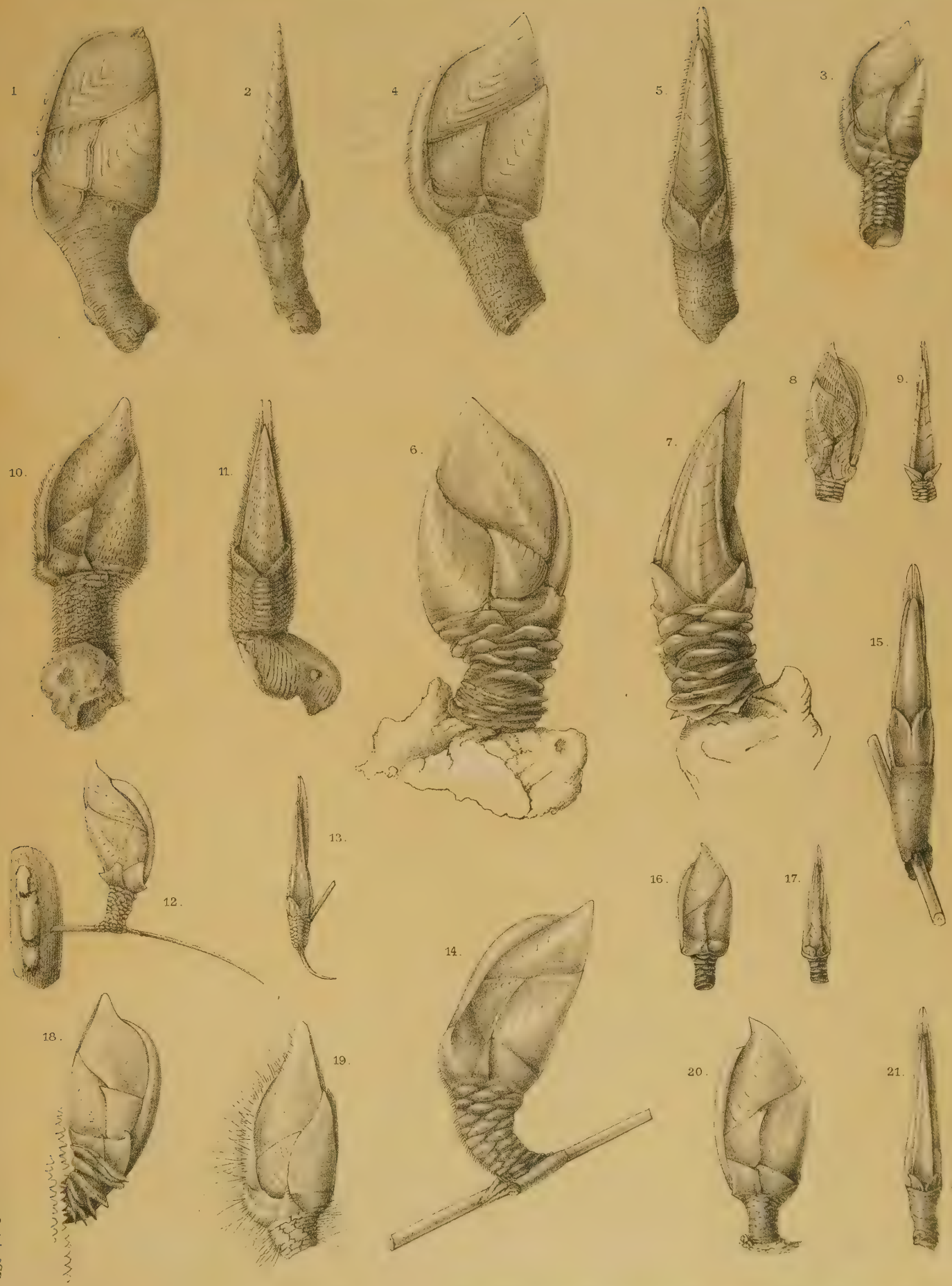


Fig. 18 & 19 P.P.C. Hoek. Cet. A.C. Drechsler Del. P.W.M. Trap Impr. A.J. Wendel, Lithogr.

1-2 SCALPELLUM GIGAS, n. sp. 3-5 SC. REGIUM, Wyv. Thomson. 6-7 SC. EXIMIUM, n. sp. 8-9 SC. ELONGATUM, n. sp. 10-11 SC. VELUTINUM, n. sp. 12-13 SC. PLANUM, n. sp. 14-15 SC. DUBIUM, n. sp. 16-17 SC. ANTARCTICUM, n. sp. 18 SC. RUBRUM, n. sp. 19 SC. HIRSUTUM, n. sp. 20-21 SC. TENUE, n. sp.

PLATE V.

PLATE V.

Figs. 1, 2. *Scalpellum darwinii*, n. sp.

Fig. 1. Animal, lateral view; natural size.
Fig. 2. Animal, seen from the carinal side; natural size.

Figs. 3, 4. *Scalpellum moluccanum*, n. sp.

Fig. 3. Animal, lateral view; natural size.
Fig. 4. Animal, seen from the carinal side; natural size.

Figs. 5, 6. *Scalpellum regium* (Wyv. Thoms.), n. sp., var. *ovale*.

Fig. 5. Animal, lateral view; natural size.
Fig. 6. Animal, seen from the carinal side; natural size.

Figs. 7, 8. *Scalpellum novæ-zelandiæ*, n. sp.

Fig. 7. Animal, lateral view; magnified 6 diameters.
Fig. 8. Animal, seen from the carinal side; magnified 6 diameters.

Figs. 9, 10. *Scalpellum tritonis*, n. sp.

Fig. 9. Animal, lateral view; magnified 6 diameters.
Fig. 10. Animal, seen from the carinal side; magnified 6 diameters.

Fig. 11. *Scalpellum australicum*, n. sp.

Fig. 11. Animal, lateral view; magnified $3\frac{1}{2}$ diameters.

Fig. 12. *Scalpellum minutum*, n. sp.

Fig. 12. Animal, lateral view; magnified 6 diameters.

Fig. 13. *Scalpellum truncatum*, n. sp.

Fig. 13. Animal, lateral view; magnified 5 diameters.

Fig. 14. *Scalpellum vitreum*, n. sp.

Fig. 14. Animal, lateral view; magnified 6 diameters.

Fig. 15. *Scalpellum balanoides*, n. sp.

Fig. 15. Group of animals attached to an arm of a *Pentacrinus*; magnified 6 diameters.

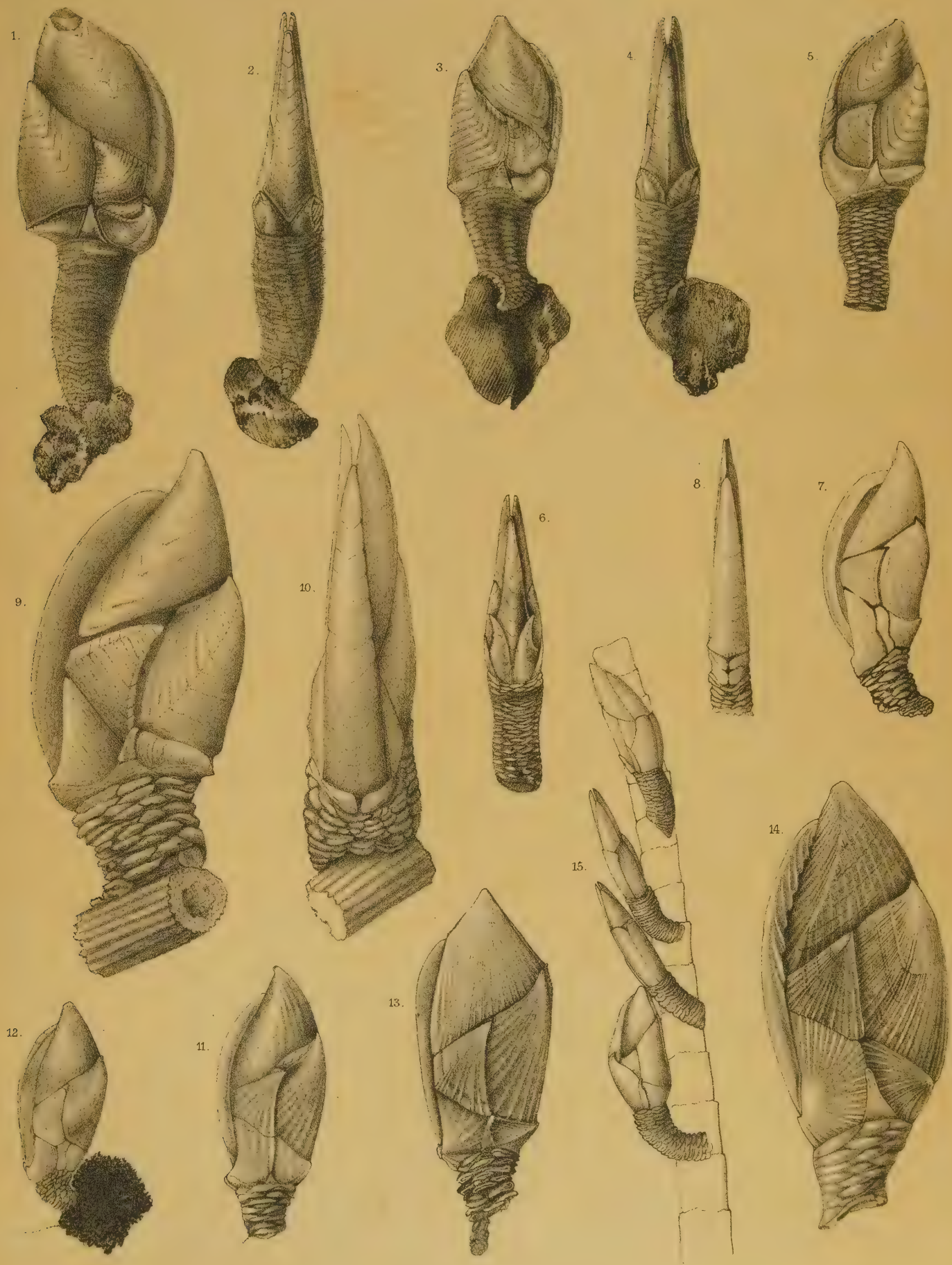


Fig. 7-10, 12-13, 15 P.P. G. Hoek Cet. A. G. Drechsler Del. A. J. Wendel Lithogr

1-2 SCALPELLUM DARWINII. 3-4 SC. MOLUCCANUM. 5-6 SC. REGIUM var. ovalis. 7-8 SC. NOVAE-ZELANDIAE.
9-10 SC. TRITONIS. 11 SC. AUSTRALICUM. 12. SC. MINUTUM. 13 SC. TRUNCATUM. 14 SC. VITREUM. 15 SC. BALANOIDES.

PLATE VI.

PLATE VI.

Figs. 1, 2. *Scalpellum pedunculatum*, n. sp.

Fig. 1. Animal, lateral view; natural size.

Fig. 2. Animal, seen from the carinal side; natural size.

Figs. 3, 4. *Scalpellum insigne*, n. sp.

Fig 3. Animal, lateral view; magnified 2 diameters.

Fig. 4. Animal, seen from the carinal side; magnified 2 diameters.

Figs. 5, 6. *Scalpellum marginatum*, n. sp.

Fig. 5. Animal, lateral view; magnified 2 diameters.

Fig. 6. Animal, seen from the carinal side; magnified 2 diameters.

Figs. 7, 8. *Scalpellum ovatum*, n. sp.

Fig. 7. Animal, lateral view; natural size.

Fig. 8. Animal seen from the carinal side; natural size.

Fig. 9. *Scalpellum flavum*, n. sp.

Fig. 9. Animal, lateral view; magnified $6\frac{1}{2}$ diameters.

Figs. 10, 11. *Scalpellum distinctum*, n. sp.

Fig. 10. Animal, lateral view; magnified 2 diameters.

Fig. 11. Animal, seen from the carinal side; magnified 2 diameters.

Fig. 12. *Scalpellum abyssicola*, n. sp.

Fig. 12. Animal, lateral view; magnified 6 diameters.

Fig. 13. *Scalpellum intermedium*, n. sp.

Fig. 13. Animal, lateral view; magnified $6\frac{1}{2}$ diameters.

Fig. 14. *Scalpellum africanum*, n. sp.

Fig. 14. Animal, lateral view; magnified $6\frac{1}{2}$ diameters.

Figs. 15, 16. *Scalpellum trispinosum*, n. sp.

Fig. 15. Animal, lateral view; magnified 2 diameters.

Fig. 16. Animal, seen from the carinal side; magnified 2 diameters.

Figs. 17, 18. *Verruca gibbosa*, n. sp.

Fig. 17. Animal, seen from the side of the movable scutum and tergum; magnified $6\frac{1}{2}$ diameters.

Fig. 18. Animal, seen from the side of the immovable scutum and tergum; magnified $6\frac{1}{2}$ diameters.

Figs. 19, 20. *Verruca sulcata*, n. sp.

Fig. 19. Animal, seen from the side of the movable scutum and tergum; magnified $6\frac{1}{2}$ diameters.

Fig. 20. Animal, seen from the side of the immovable scutum and tergum; magnified $6\frac{1}{2}$ diameters.

Figs. 21, 22. *Balanus corolliformis*, n. sp.

Fig. 21. Animal, lateral view; natural size.

Fig. 22. Animal, seen from above; natural size.

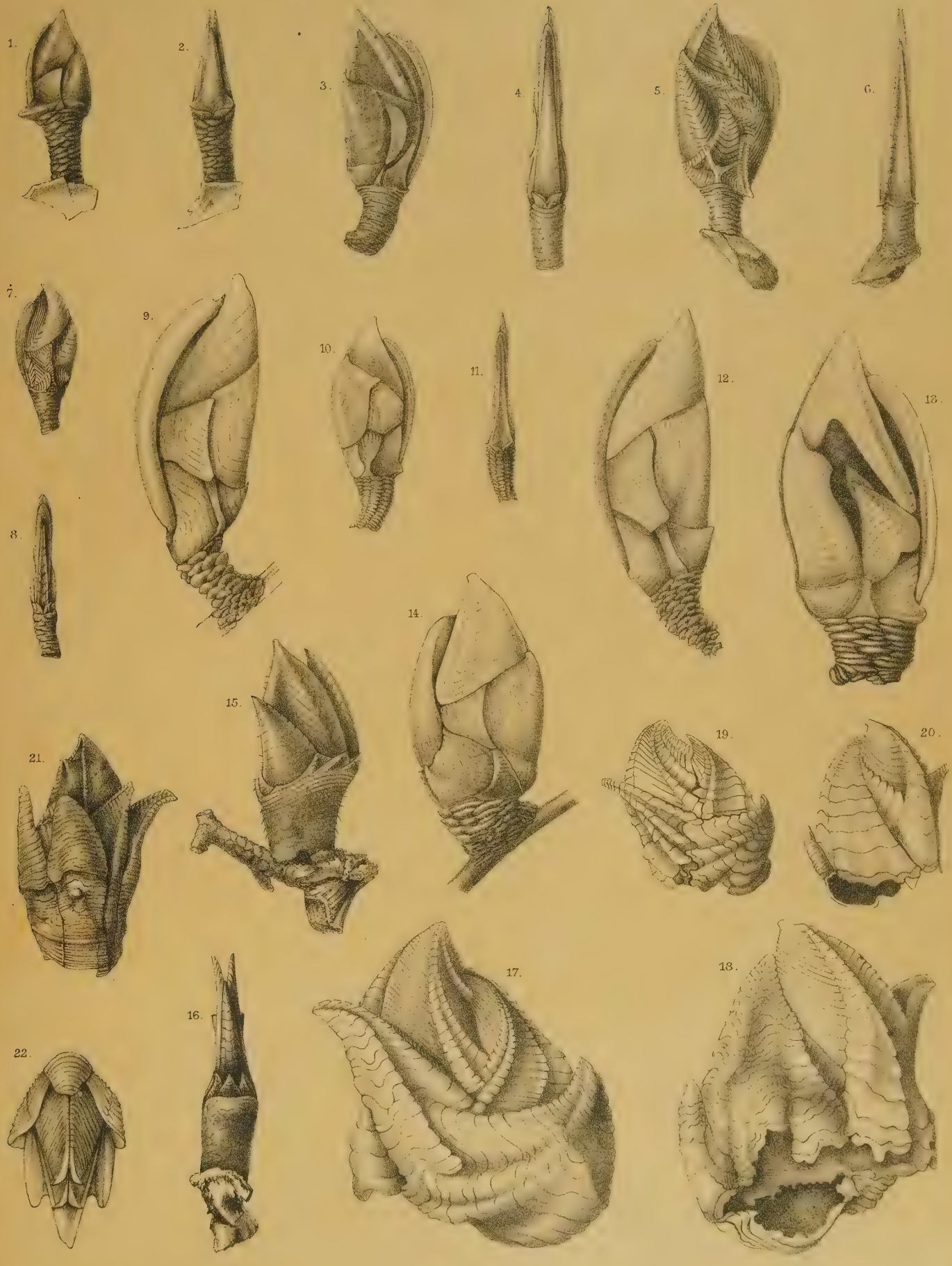


Fig. 9,12-14,17-20 P.P.C. Hoek Cet. A.G. Drechsler Del. A.J. Wendel Lithogr.

1-2 SCALPELLUM PEDUNCULATUM n. sp. 3-4 SC. INSIGNE n. sp. 5-6 SC. MARGINATUM n. sp. 7-8 SC. OVATUM n. sp. 9. SC. FLAVUM n. sp. 10-11 SC. DISTINCTUM n. sp. 12 SC. ABYSSICOLA n. sp. 13 SC. INTERMEDIUM n. sp. 14 SCAFRICANUM n. sp. 15-16 SC. TRISPINOSUM n. sp. 17-18 VERRUCA GIBBOSA n. sp. 19-20 V. SULCATA n. sp 21-22 BALANUS COROLLIFORMIS n sp

PLATE VII.

PLATE VII.

Fig. 1. *Scalpellum indicum*, n. sp.

Fig. 1. Animal, lateral view; magnified 6 diameters.

Figs. 2, 3. *Balanus lævis*, Brug.

Fig. 2. Group of animals; magnified 1½ diameters.
Fig. 3. One specimen, seen from the rostral side; magnified 2 diameters.

Figs. 4, 5. *Balanus amaryllis*, Darwin.

Fig. 4. Group of animals; magnified 1½ diameters.
Fig. 5. One specimen, seen from above; magnified 1½ diameters.

Figs. 6, 7. *Pœcilasma carinatum*, n. sp.

Fig. 6. Carina, interior view; magnified 4 diameters.
Fig. 7. Mandible of the left side; magnified 62 diameters.

Figs. 8, 9. *Megalasma striatum*, n. sp.

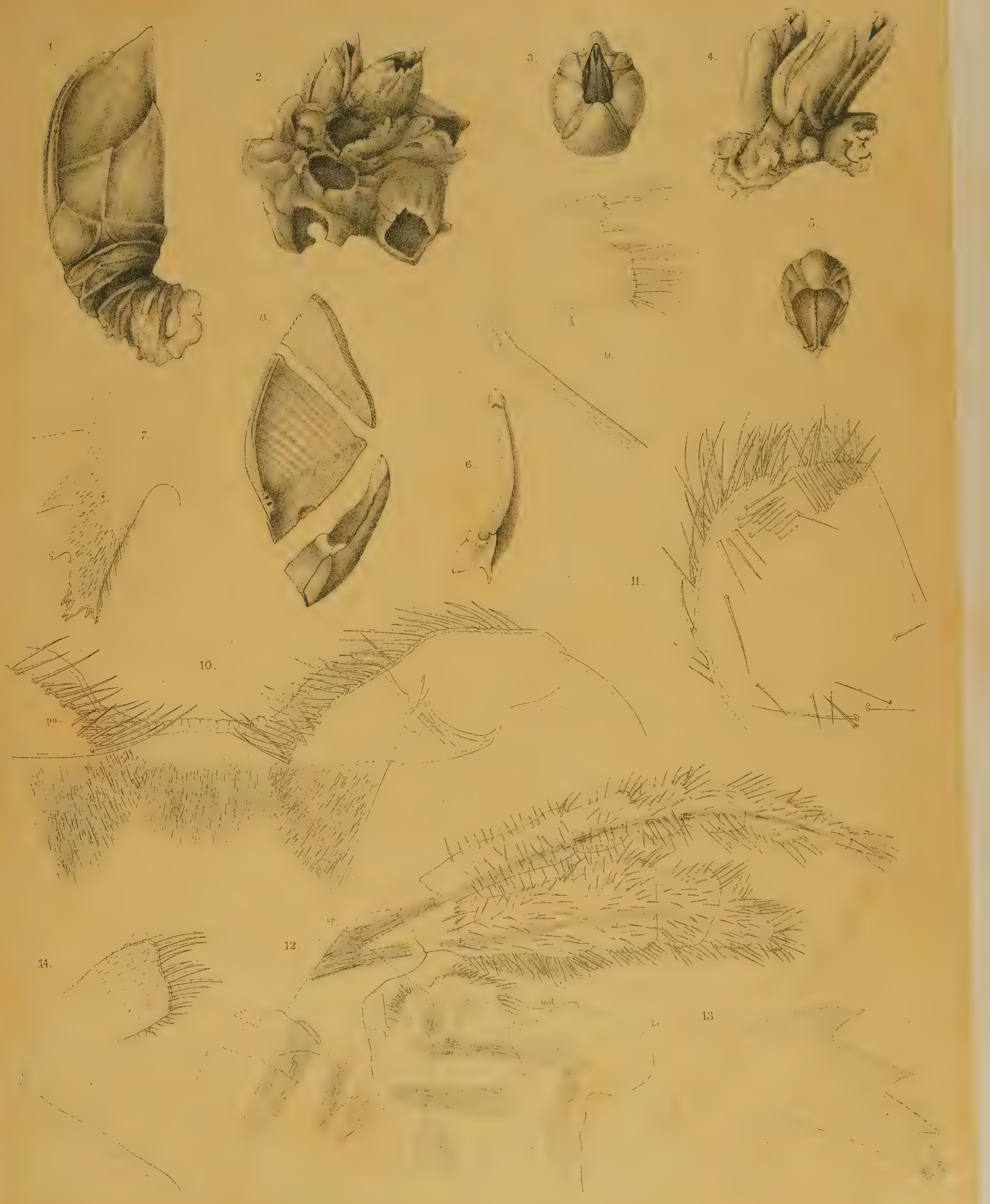
Fig. 8. Tergum, scutum, and carina, interior view; magnified 6 diameters.
Fig. 9. Maxilla; magnified 94 diameters.

Figs. 10, 11. *Alepas pedunculata*, n. sp.

Fig. 10. Labrum with the palpi (*pa.*); magnified 94 diameters.
Fig. 11. Second maxilla; magnified 94 diameters.

Figs. 12–14. *Scalpellum stroemii*, Sars.

Fig. 12. Mouth and first cirrus; magnified 41 diameters. *la.*, labrum; *md.*, mandible *sm.*, second maxilla; c^1, first cirrus.
Fig. 13. Mandible; magnified 94 diameters.
Fig. 14. Maxilla; magnified 94 diameters.



1 SCALPELLUM INDICUM n.sp. 2-3 BALANUS LAEVIS Brug. 4-5 B. AMAPYLLIS Darw. 6-7 POECILASMA CARINATA Hoek.
8-9 MEGALASMA STRIATA Hoek. 10-11 ALEPAS PEDUNCULATA Hoek. 12-14 SCALPELLUM STRÖMII Sars.

PLATE VIII.

PLATE VIII.

Figs. 1–5. *Scalpellum stroemii*, Sars.

Fig. 1. Larva in the Cypris-stage; magnified 94 diameters.

Fig. 2. Complemental male; magnified 94 diameters. *an.*, antennæ.

Fig. 3. Complemental male; magnified 94 diameters. *t.*, testis; *rs.*, receptaculum seminis; *o.*, genital aperture (?).

Fig. 4. Scutum, interior view to show the place where the complemental male is attached; magnified 8 diameters. *a.*, complemental male; *m.*, cavity for the adductor muscle.

Fig. 5. Second maxilla; magnified 94 diameters.

Figs. 6–8. *Scalpellum intermedium*, n. sp.

Fig. 6. Mandible; magnified 94 diameters.

Fig. 7. Maxilla; magnified 94 diameters.

Fig. 8. Complemental male; magnified 94 diameters.

Figs. 9, 10. *Scalpellum recurvirostrum*, n. sp.

Fig. 9. Maxilla; magnified 94 diameters.

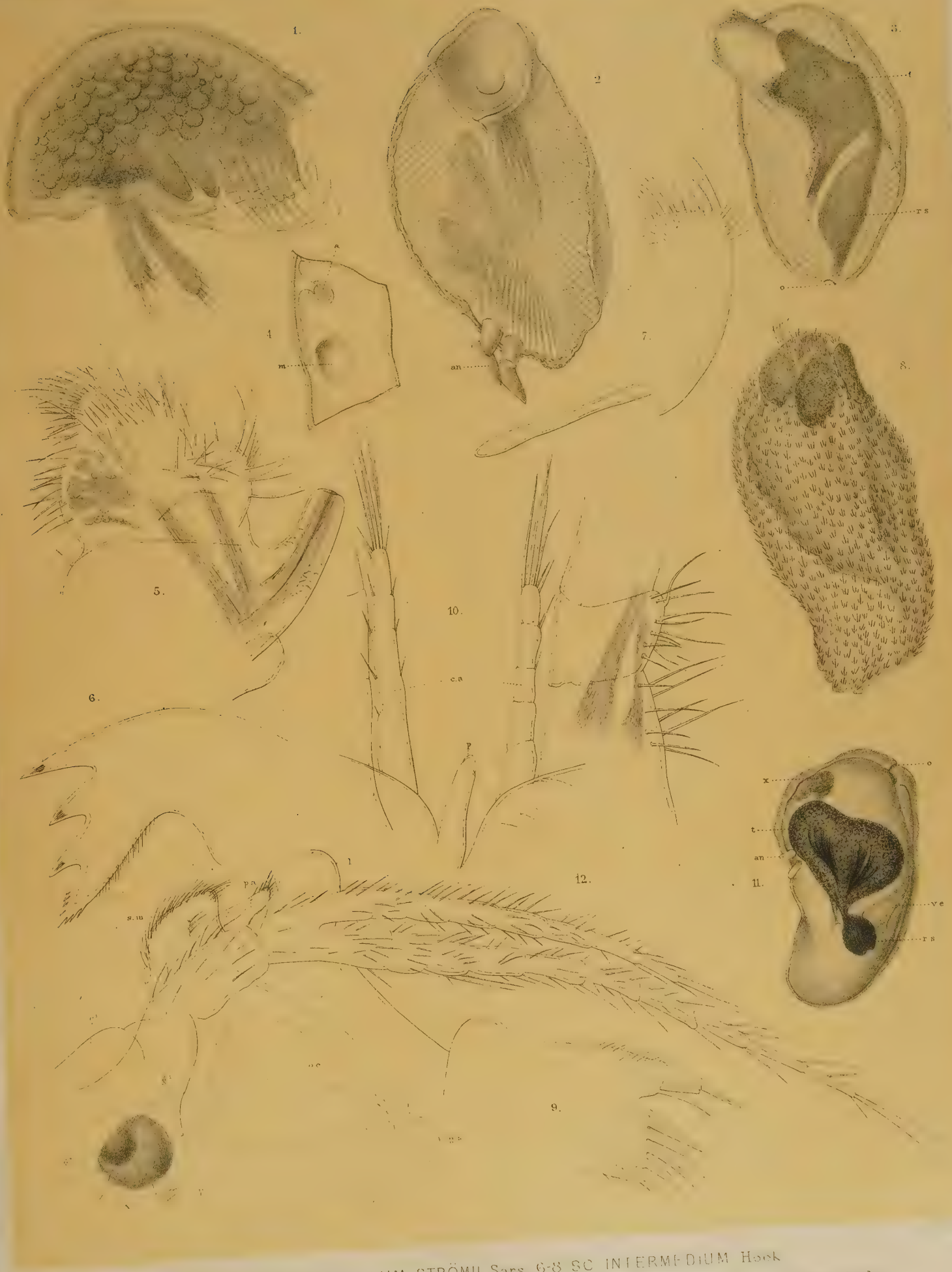
Fig. 10. Caudal appendages; magnified 41 diameters. *ca.*, caudal appendages; *c.*, sixth cirrus; *p.*, penis.

Fig. 11. *Scalpellum compressum*, n. sp.

Fig. 11. Complemental male; magnified 41 diameters. *an.*, antennæ; *t.*, testis; *rs.* receptaculum seminis; *v.e.*, vas defernes; *o.*, genital aperture; *x.*, organ of unknown function.

Fig 12. *Scalpellum acutum*, n. sp.

Fig. 12. Mouth and first pair of cirri; magnified 41 diameters. *l.*, labrum; *pa.*, palpi; *sm.*, second maxilla; c^1, first cirrus; ♀ opening of the oviduct; *oe.*, œsophagus; *gs.*, ganglion supraœsophageale; g^1 and g^2, first and second thoracic ganglia; *x.*, so-called auditory sac.



1-5 SCALPELLUM STRÖMII Sars 6-8 SC. INTERMEDIUM Hoek

9-10 SC. RECURVIROSTRUM Hoek 11 SC. COMPRESSUM Hoek 12 SC. ACUTUM Hoek

PLATE IX.

PLATE IX.

Figs. 1–5. *Scalpellum parallelogramma*, n. sp.

Fig. 1. Mandible; magnified 94 diameters.
Fig. 2. Maxilla; magnified 94 diameters.
Fig. 3. Second maxilla; magnified 41 diameters.
Fig. 4. First cirrus; magnified 6 diameters. *g.o.*, female genital pore.
Fig. 5. Female genital pore at the base of the first cirrus; magnified 41 diameters.

Fig. 6. *Scalpellum nymphocola*, n. sp.

Fig. 6. Part of the interior surface of the scutum, with the complemental male attached to it; magnified 94 diameters. *a.*, margin of the valve; *b.*, exterior; *c.*, interior layer of the mantle, between which two layers the male is attached; *d.*, musculus adductor scutorum.

Figs. 7–9. *Scalpellum velutinum*, n. sp.

Fig. 7. Male in the pupa-stage; magnified 41 diameters.
Fig. 8. Male in a somewhat older stage; magnified 94 diameters. *t.*, testis; *c. gl.*, glands at the base of the antennæ, probably cement glands.

N.B.—In this and in the following figures the male genital apparatus is coloured red.

Fig. 9. Male in a nearly ripe condition; magnified 41 diameters.

Figs. 10, 10*. *Scalpellum eximium*, n. sp.

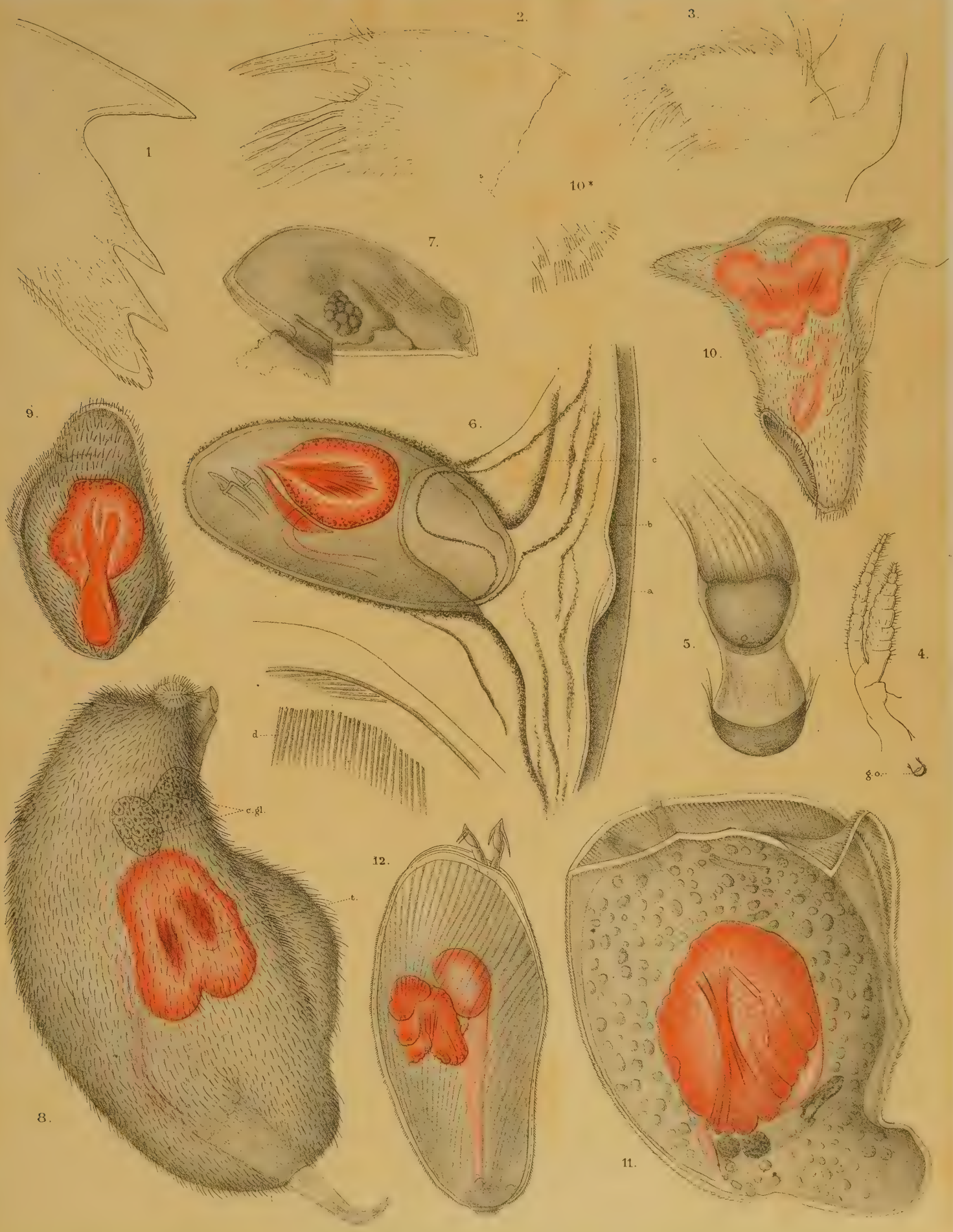
Fig. 10. Male; magnified 41 diameters.
Fig. 10*. Spines attached to the surface of the male; strongly magnified.

Fig. 11. *Scalpellum gigas*, n. sp.

Fig. 11. Complemental male; magnified 94 diameters.

Fig. 12. *Scalpellum regium* (Wyv. Thoms.), n. sp.

Fig. 12. Complemental male; magnified 41 diameters.



P.P.C.Hoek.Del. A.J.Wendel Lithogr

1-5 SCALPELLUM PARALLELOGRAMMA, Hoek. 6 SC. NYMPHOCOLA, Hoek. 7-9 SC. VELUTINUM, Hoek.
10 SC. EXIMIUM, Hoek. 11 SC. GIGAS, Hoek. 12 SC. REGIUM, (W. Th.) Hoek.

PLATE X.

PLATE X.

Figs. 1, 2. *Scalpellum regium* (Wyv. Thoms.), n. sp.

Fig. 1. Mouth and first pair of cirri; magnified 6 diameters.
Fig. 2. Edge of the maxilla; magnified 94 diameters.

Figs. 3–5. *Scalpellum darwinii*, n. sp.

Fig. 3. Complemental male; magnified 40 diameters.
Fig. 4. Genital apparatus of the male; magnified 94 diameters. *t.* testis; *r.s.*, receptaculum seminis; *v.e.*, vas deferens; *x.*, probably nervous system.
Fig. 5. Nervous system of the male strongly (275 diameters) magnified.

Fig. 6. *Scalpellum tenue*, n. sp.

Fig. 6. Complemental male; magnified 94 diameters.

Figs. 7–9. *Scalpellum flavum*, n. sp.

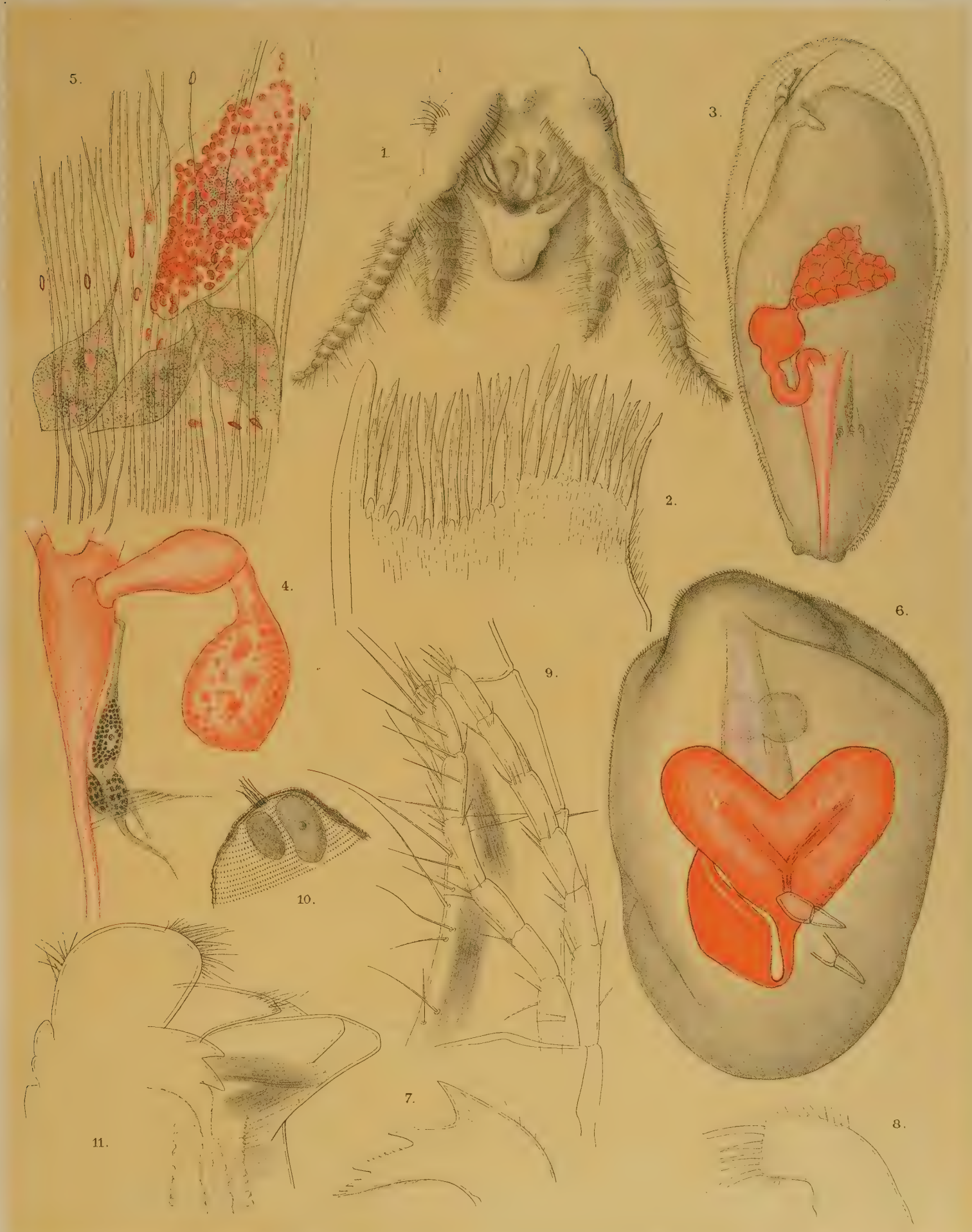
Fig. 7. Mandible; magnified 94 diameters.
Fig. 8. Maxilla; magnified 94 diameters.
Fig. 9. Caudal appendages; magnified 94 diameters.

Fig. 10. *Scalpellum tritonis*, n. sp.

Fig. 10. Rudimentary valves of the complemental male; magnified 94 diameters.

Fig. 11. *Scalpellum balanoides*, n. sp.

Fig. 11. Mouth; magnified 94 diameters.



P. P. C. Hoek. Del. A. J. Wendel Lithogr.

1-2 SCALPELLUM REGIUM, (Wyv. Thoms.) Hoek. 3-5 SC. DARWINII, Hoek. 6 SC. TENUE, Hoek.
7-9 SC. FLAVUM, Hoek. 10 SC. TRITONIS, Hoek. 11 SC. BALANOIDES, Hoek.

PLATE XI.

PLATE XI.

Figs. 1–3. *Scalpellum balanoides*, n. sp.

Fig. 1. Mandible; magnified 270 diameters.
Fig. 2. Maxilla and second maxilla; magnified 94 diameters.
Fig. 3. Caudal appendages; magnified 94 diameters.

Fig. 4. *Scalpellum triangulare*, n. sp.

Fig. 4. Maxilla; magnified 94 diameters.

Figs. 5–9. *Verruca gibbosa*, n. sp.

Fig. 5. Labrum, with palpi; magnified 94 diameters.
Fig. 6. and 6*. Left and right hand mandible; magnified 94 diameters.
Fig. 7. Maxilla; magnified 94 diameters.
Fig. 8. Second maxilla; magnified 94 diameters.
Fig. 9. Cirri, penis, and caudal appendages; magnified 39 diameters.

Figs. 10, 11. *Verruca quadrangularis*, n. sp.

Fig. 10. Mandible; magnified 270 diameters.
Fig. 11. Maxilla; magnified 270 diameters.

F W Hyde Del

1-3 SCALPELLUM BALANOIDES, n. sp. 4 SC TRIANGULARE, n sp 5-9 VERRUCA GIBBOSA, n sp
10-11 V QUADRANGULARIS, n. sp.

PLATE XII.

PLATE XII.

Figs. 1–5. *Verruca gibbosa*, n. sp.

Fig. 1. Tergum, exterior view; magnified 7½ diameters.
Fig. 2. Scutum, exterior view; magnified 7½ diameters.
Fig. 3. Scutum and tergum attached to one another, interior view; magnified 5½ diameters.
Fig. 4. Scutum, interior view; magnified 7½ diameters.
Fig. 5. Tergum, interior view; magnified 7½ diameters.

Figs. 6–7. *Verruca nitida*, n. sp.

Fig. 6. Animal, seen from the side of the movable scutum and tergum; magnified 9 diameters.
Fig. 7. Animal, seen from the side of the immovable scutum and tergum; magnified 9 diameters.

Figs. 8–12. *Verruca quadrangularis*, n. sp.

Fig. 8. Animal, seen from the side of the movable scutum and tergum; magnified 7½ diameters.
Fig. 9. Animal, seen from the side of the immovable scutum and tergum; magnified 7½ diameters.
Fig. 10. Scutum and tergum, interior view; magnified 9 diameters.
Fig. 11. Tergum, exterior view; magnified 9 diameters.
Fig. 12. Scutum, exterior view; magnified 9 diameters.

Figs. 13, 14. *Verruca incerta*, n. sp.

Fig. 13. Animal, seen from the side of the movable scutum and tergum; magnified 9 diameters.
Fig. 14. Animal, seen from the side of the immovable scutum and tergum; magnified 9 diameters.

Figs. 15, 16. *Verruca obliqua*, n. sp.

Fig. 15. Animal, seen from the side of the movable scutum and tergum; magnified 7½ diameters.
Fig. 16. Animal, seen from the side of the immovable scutum and tergum; magnified 7½ diameters.

Fig. 17. *Verruca obliqua*, var.

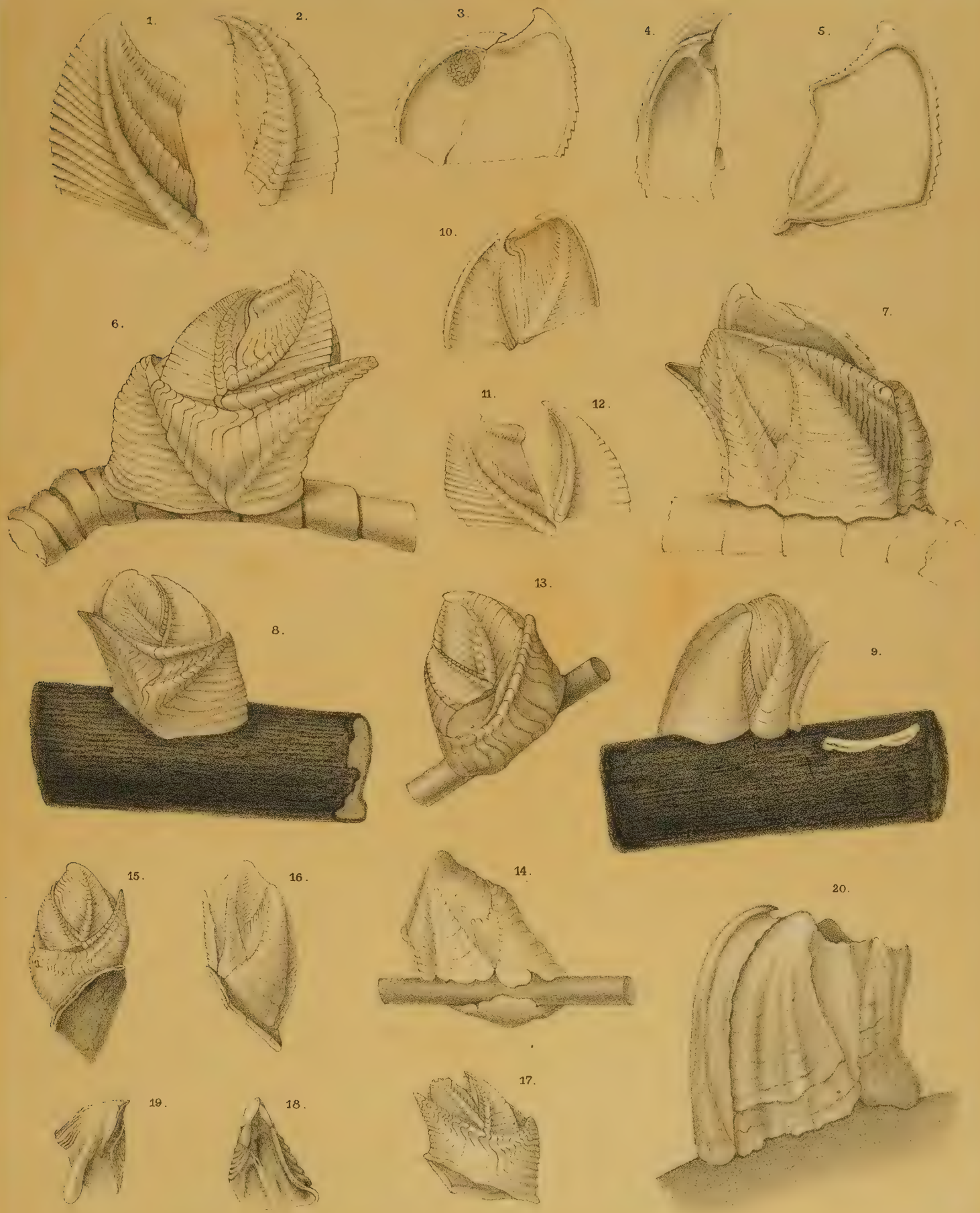
Fig. 17. Animal, seen from the side of the movable scutum and tergum; magnified 7½ diameters.

Figs. 18, 19. *Balanus tintinnabulum*, Linn., sp., var. *communis*, Darwin.

Fig. 18. Scutum, interior view; natural size.
Fig. 19. Tergum, interior view; natural size.

Fig. 20. *Balanus trigonus*, Darwin.

Fig. 20. Animal, lateral view; magnified 5 diameters.



P. P. C. Hoek, Del. A.J. Wendel, Lithogr.

1-5 VERRUCA GIBBOSA, n. sp. 6-7 V. NITIDA, n. sp. 8-12 V. QUADRANGULARIS, n. sp. 13-14 V. INCERTA, n. sp. 15-16 V. OBLIQUA, n. sp
17 V. OBLIQUA, var. 18-19 BALANUS TINTINNABULUM, var. communis. 20 B. TRIGONUS, Darwin.

PLATE XIII.

PLATE XIII.

Figs. 1–7. *Balanus corolliformis*, n. sp.

Fig. 1. Tergum, exterior view; magnified $1\frac{1}{4}$ diameters.
Fig. 2. Scutum, exterior view; magnified $1\frac{1}{4}$ diameters.
Fig. 3. Tergum, interior view; magnified $1\frac{1}{4}$ diameters.
Fig. 4. Scutum, interior view; magnified $1\frac{1}{4}$ diameters.
Fig. 5. Labrum; magnified 20 diameters.
Fig. 6. Mandible; magnified 20 diameters.
Fig. 7. Maxilla; magnified 20 diameters.

Figs. 8–15. *Balanus hirsutus*, n. sp.

Fig. 8. Group of specimens attached to a spine; magnified $1\frac{1}{2}$ diameters.
Fig. 9. Tergum, exterior view; magnified 5 diameters.
Fig. 10. Scutum, exterior view; magnified 5 diameters.
Fig. 11. Tergum, interior view; magnified 5 diameters.
Fig. 12. Scutum; interior view; magnified 5 diameters.
Fig. 13. Labrum; magnified 41 diameters.
Fig. 14. Mandible; magnified 41 diameters.
Fig. 15. Maxilla; magnified 41 diameters.

Figs. 16–22. *Balanus rostratus*, n. sp.

Fig. 16. Animal, lateral view; magnified $2\frac{1}{2}$ diameters.
Fig. 17. Animal, front view; magnified $2\frac{1}{2}$ diameters.
Fig. 18. Tergum, exterior view; magnified $7\frac{1}{2}$ diameters.
Fig. 19. Scutum, exterior view; magnified $7\frac{1}{2}$ diameters.
Fig. 20. Tergum, interior view; magnified $7\frac{1}{2}$ diameters.
Fig. 21. Scutum, exterior view; magnified $7\frac{1}{2}$ diameters.
Fig. 22. Maxilla; magnified 94 diameters.

Figs. 23–28. *Balanus socialis*, n. sp.

Fig. 23. Group of specimens; magnified $1\frac{1}{2}$ diameters.
Fig. 24. One of the specimens; magnified 4 diameters.
Fig. 25. Tergum, exterior view; magnified $7\frac{1}{2}$ diameters.
Fig. 26. Scutum, exterior view; magnified $7\frac{1}{2}$ diameters.
Fig. 27. Tergum, interior view; magnified $7\frac{1}{2}$ diameters.
Fig. 28. Scutum, interior view; magnified $7\frac{1}{2}$ diameters.

Figs. 29–33. *Balanus tenuis*, n. sp.

Fig. 29. Animal, lateral view; magnified $2\frac{1}{2}$ diameters.
Fig. 30. Scutum, exterior view; magnified $7\frac{1}{2}$ diameters.
Fig. 31. Tergum, exterior view; magnified $7\frac{1}{2}$ diameters.
Fig. 32. Scutum, interior view; magnified $7\frac{1}{2}$ diameters.
Fig. 33. Tergum, interior view; magnified $7\frac{1}{2}$ diameters.

Fig. 34. *Tetraclita coerulescens*, Spengler, sp.

Fig. 34. Tergum, interior view; magnified 4 diameters.

Figs. 35–38. *Chthamalus challengeri*, n. sp.

Fig. 35. Animal, front view; magnified $7\frac{1}{2}$ diameters.
Fig. 36. Animal, lateral view; magnified $7\frac{1}{2}$ diameters.
Fig. 37. Scutum, interior view; magnified 13 diameters.
Fig. 38. Tergum, interior view; magnified 13 diameters.

Fig. 16, 17, 23, 24, 29, 35 et 36 Drechsler Cet. P.P.C. Hoek Del. A.J. Wendel. Lithogr.

1-7 BALANUS COROLLIFORMIS, n. sp. 8-15 B. HIRSUTUS, n. sp. 16-22 B. ROSTRATUS, n. sp. 23-28 B. SOCIALIS, n. sp. 29-33 B. TENUIS, n. sp. 34 TETRACLITA CŒRULESCENS, Spengler, spec. 35-38 CHTHAMALUS CHALLENGERI, n. sp.